COMORBIDITIES IN PSORIASIS

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CERTIFICATE

Certified that this dissertation entitled **"COMORBIDITIES IN PSORIASIS"** is a bonafide work done by **Dr.M.NITHYA,** Post Graduate Student of the Department of Dermatology, Venereology and Leprosy, Madras Medical College, Chennai – 600003, during the academic year 2009 – 2012. This work has not previously formed the basis for the award of any degree.

Prof. Dr.S.Jayakumar, M.D., D.D.,
Professor and Head of the Department,
Department of Dermatology and Leprosy,
Madras Medical College,
Chennai – 600003.

Prof. Dr. V. Kanagasabai, M.D.,
Dean,
Madras Medical College,
Chennai – 600003.

DECLARATION

I, **Dr. M. NITHYA,** solemnly declare that dissertation titled, "**COMORBIDITIES IN PSORIASIS"** is a bonafide work done by me at Department of Dermatology and Leprosy, Madras Medical College, Chennai-3 during the period of October 2009 to September 2011 under the supervision of my **Prof. Dr.S.JAYAKUMAR, M.D, D.D,** Professor and HOD, The Department of Dermatology and Leprosy, Madras Medical College, Chennai. The dissertation is submitted to Tamilnadu Dr. M.G.R. Medical University, towards partial fulfilment of requirement for the award of **M.D. Degree (Branch-XII A) in DERMATOLOGY, VENEREOLOGY AND LEPROSY**.

Signature of the Candidate

Place: Chennai

Date:

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CONTENTS

INTRODUCTION

Psoriasis is a common, chronic, inflammatory papulosquamous disorder of skin in which both genetic and environmental factors have a critical role. It is characterized by dull red, scaly, indurated plaque, having a chronic course with remission and exacerbation.

It is a widespread disease with worldwide prevalence of 0.6-4.8%[(1)]. Among the patients attending hospitals in India, the prevalence is about 0.8-5.6%[(2)]. It affects all the age groups, and its prevalence in children younger than 18 years is 0.71%[(3)].

Comorbidity is the occurrence of one or multiple disorder(s) in association with a given disease[(4,5)]. This has gained interest in various fields of medicine in recent times and often appears to be due to common pathogenic pathways[(4,6)]. Comorbidities tend to arise in complex disorders, they are frequently multigenic & multifactorial and most often demonstrate an inflammatory background[(4)]. Psoriasis is associated with numerous comorbidities which has a major impact on severely affected patients[(4,7)].

Knowledge of comorbidities in psoriasis is of substantial importance because of the following aspects:

1. The concomitance of other diseases leads to intake of medications that could affect the onset, severity and course of psoriasis

2. Medications used to treat psoriasis may positively or negatively influence the comorbidities

3. An association to distinct diseases could help to obtain a deeper insight into the pathogenesis of psoriasis

4. Therapeutic management of patients with psoriasis needs to be adapted to the prevalence of other diseases and medication[8].

As dermatologists are often the first consulted healthcare specialists by patients with psoriasis, we should be aware of these comorbidities and this study is designed for the purpose of studying these comorbidities.

REVIEW OF LITERATURE

Epidemiological studies have demonstrated a significant association between psoriasis and other diseases, known as comorbidities[8,9]. Nearly half of the psoriatic patients aged over 65 years have atleast three comorbidities and two third have two or more comorbidities[6]. They often become clinically manifest years after the onset of disease[10] in moderate to severe psoriasis[11].

Emerging comorbidities in psoriasis include cardiovascular disease and metabolic syndrome[12]. The components of metabolic syndrome are diabetes mellitus, hypertension, obesity[13] and dyslipidemia[12]. Of these diabetes mellitus shows the highest frequency followed by hypertension[14].

The systemic disorders associated with psoriasis include non-alcoholic fatty liver disease[15], gout, ulcerative colitis, crohn's disease[14] , depression[16] and osteoporosis[17].

Other comorbid conditions significantly associated with psoriasis are sleep disorders or insomnia, chronic obstructive pulmonary disease and gastroesophageal reflux disease[18]. Renal failure and hepatitis are the least likely comorbidities[19]. Psoriatic patients are at the increased risk of malignancy particularly non-melanoma skin cancer and lymphoproliferative diseases[20].

Like in adults, psoriasis is associated with significant comorbidity in children too. A German study shows that the overall rate of comorbidities in psoriasis in those aged under 20 years were high when compared to controls. Increased rates of hyperlipidemia, obesity, hypertension, diabetes mellitus, rheumatoid arthritis and crohn's disease were observed in them[3].

Epidemiological studies from US, UK, Italy, other European countries, Taiwan and Israel confirm the association between psoriasis and metabolic syndrome, but only scanty data are available on this subjects from South Asian countries[11].

In a study carried out in Chennai, Tamilnadu, with 120 psoriasis patients, 55.8% had comorbidities and the results is shown in the chart given below[21].

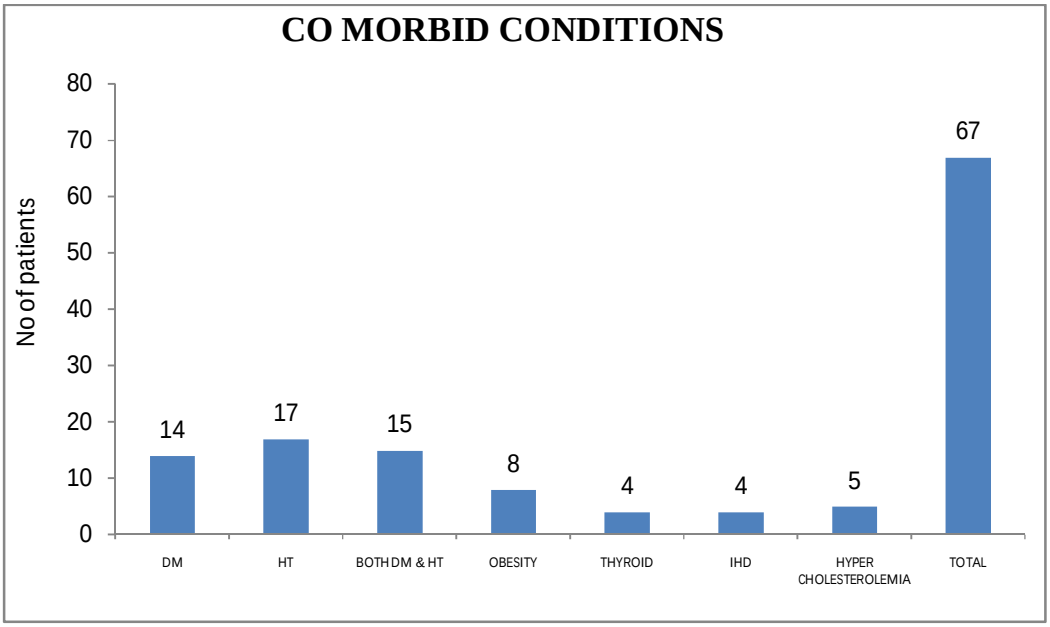


Table showing percentage distribution of comorbid conditions in psoriasis[21].

Co – morbid conditions		Number of patients	Percentage of patients
DM		14	11.6%
HT		17	14.1%
Both DM and HT		15	12.5%
Others	Obesity	8	6.6%
	Thyroid disorder	4	3.3%
	Ischaemic Heart Disease	4	3.3%
	Hyper Cholesterolemia	5	4.1%
Total		67	55.8%

PATHOGENESIS

The connection between psoriasis and atherosclerosis may be due to an increased prevalence of atherosclerotic risk factors as well as to the chronic inflammation that occurs in psoriasis.

In order to understand the relationship between coronary artery disease and psoriasis, it is important to review the commanalities in their pathophysiology.

Psoriasis is an immune disease, characterized by inappropriate activation of cellular immune system directed against self-antigens[22].

For more than a decade, the fundamental pathophysiology has been thought to be related to T helper 1(Th_1) mediated cellular dysfunction which produces systemic inflammation and a concurrent increase in cytokine production[22,23].

In short, an antigen-presenting cell (APC) identifies and processes a yet-to-be identified antigen in the skin. APC then presents the processed antigen in a major histocompatability class II-restricted fashion, and activates naive T cells in the local lymphnodes, resulting in a clonal expression of Th_1 arm under the influence of interleukin (IL)-2. These activated Th_1 clones enter the circulation and through the process of diapedesis, they permeate the endothelium and cause an inflammatory reaction in the affected skin. The cytokines driving this response are, of course are tumor necrosis factor(TNF-α), IL-2 and interferon(IFN)-γ of Th_1 profile. This in turn, leads to the recruitment of other immune cells and expression of vascular endothelial growth factor, leading to vascular proliferation. Krueger and Bowcock characterized the process as many interactive responses between infiltrating leukocytes, resident skin cells, and an array of pro-inflammatory cytokines, chemokines and chemical mediators produced in the skin under regulation of cellular immune system. Heredity and environmental factors may interact with this complex inflammatory process to modify further the clinical expression of the disease. The severity of the disease is related to this inflammatory response.

Similar inflammatory processes occur in the development of atherosclerosis, a chronic immunoinflammatory disease of arterial wall. Inflammation is crucial in all stages of atherosclerosis. It is implicated not only in the formation of fatty streaks, but also with adverse clinical vascular events. During the rupture of an unstable atherosclerotic plaque, activated inflammatory cells within the plaque secrete matrix proteases leading to the degradation of extracellular matrix proteins, weakening of the fibrous cap, leading to rupture and thrombus formation. The activation of inflammatory process and upregulation of Th_1 mediated cytokine cascades (with IFN-γ, TNF-α, IL-1and IL-6) is a possible trigger for acute coronary syndromes as well as psoriasis, as described above [(22)].

Decades of chronic angiogenesis necessary to maintain the psoriasis phenotype could also theoretically be related to cardiovascular disorders through exhausting the pool of endothelial precursor cells (EPCs) in the bone marrow, which are believed to play a critical role in maintenance of endothelial integrity, function, and repair. Furthermore, many of the inflammatory mediators and cell adhesion molecules increased in psoriasis can directly promote endothelial cell activation and dysfunction, leading to cardiovascular disease. Consistent with this hypothesis, patients with psoriatic arthritis without cardiovascular risk factors or clinically evident cardiovascular disease have been shown to exhibit endothelial dysfunction. Chronic psoriasis also impacts oxidative metabolic pathways which may have systemic implications, especially

with respect to atherosclerosis and Myocardial infarction. Inflamed psoriatic skin generates free radicals, reactive oxygen species (ROS) and results in superoxide anion liberation. On the cellular level, even those with mild psoriasis display an disequilibrium between markers of oxidative stress and antioxidants. Psoriasis may further promote oxidative stress through an association with decreased folic acid levels and increased homocysteine levels[13].

In addition, local stimulation of smooth muscle cells in the arterial wall amplifies the inflammatory response and promotes a precoagulant milieu. As macrophages, T lymphocytes and smooth muscle cells are activated there is a further progressive amplification of proinflammatory cytokines, chemokines and growth factors that also promote atherogenesis[22].

Although inflammatory cytokines such as TNFα have been extensively studied, emerging data have recently demonstrated the central role of IL-20 and IL-17 in the pathogenesis of psoriasis. IL-17 is secreted by a new subclass of CD4+ cells, the Th_{17} cells and this plays an important role in the pathogenesis of psoriasis. It also activates inflammation in a variety of organ systems. For example, IL-17 is elevated in the sera of patients with unstable coronary artery disease and is also preferentially expressed in animal models of aged coronary arteries that are susceptible to ischemia[13].

Interestingly recent data suggest that a unique T-cell subset, T-IL-17, mediates IL-12 and IL-23 and these have an important role in the pathogenesis of psoriatic lesions. Monoclonal antibodies against a subunit shared by IL-12 and IL-23 are undergoing therapeutic trials as promising new therapies for psoriasis. It is the circulating IL-12 that is thought to be the link between inflammation and Th_1 type cytokine production in coronary atherosclerosis[22].

It is important to note that the risk of coronary artery disease is also increased in other systemic inflammatory diseases such as rheumatoid arthritis and systemic lupus erythematosus, and hence systemic inflammation in psoriasis is in part responsible for the increased risk of myocardial infarction[24].Several groups have proposed similar hypothesis and have implicated both proinflammatory cascades as well as angiogenesis[22].

The relationship between psoriasis and metabolic syndrome is likely to be due to the chronic inflammatory nature of psoriasis with increased TNFα[10,12]. Similar to psoriasis, the metabolic syndrome is characterized by an increase in the activity of type 1 helper T cells[25]. Recent studies investigating the effect of Tumor Necrosis Factor antagonists on the treatment of cardiovascular disease and metabolic syndrome support this concept[12].

It is hypothesized that proinflammatory cytokines constribute to obesity, dyslipidemia, atherogenesis, peripheral insulin resistance, type II diabetes, hypertension etc. This is supported by following observations.

1. The adipocytes release adipocytokines or adipokines e.g. adiponectin, leptin, resistin, plasminogen activator inhibitor type 1 as well as TNF-α. Resistin mediates insulin resistance.

2. TNF-α and IL-6 induce insulin resistance, dyslipidemia and procoagulant effect. IL-6 causes increased C reactive protein levels and erythrocyte sedimentation rate. Elevated erythrocyte sedimentation rate in psoriasis and obesity may be the predictor of coronary heart disease[(11)].

3. The thiazolidinediones are beneficial in both diabetes and psoriasis. The thiazolidinediones have anti-inflammatory properties. This supports the role of inflammation between them[(26)].

4. Systemic inflammation in psoriasis leads to endothelial dysfunction i.e.imbalance of vasoconstrictor(endothelin-1) and vasodilator factors (nitric oxide). TNF-α release in psoriasis induces insulin resistance which inturn reduces the activity of endothelial NO synthetase; however, mitogen activated kinase e.g. p38MAPK remains active and adhesion molecules and vasoconstrictors are synthesized. Increased endothelin levels constribute to the pathogenesis of systemic and pulmonary hypertension.

5. In psoriasis, increased levels of angiotensin converting enzyme, endothelin-1 and renin are seen. Angiotensin II is a vasoconstrictor, degrades bradykinin (a vasodilator) and enhance the levels of plasminogen activator inhibitor-1, thus promoting thrombotic state[11].

6. Immunocytes and keratinocytes in the psoriatic skin produce angiogenic factors, such as VEGF, which promote angiogenesis and endothelial cell activation. VEGF levels are increased in plaques of psoriasis and serum concentration of VEGF correlates with clinical severity of disease. VEGF is also increased in hyperinsulinemic states like metabolic syndrome in which adipocytes are its primary source. Therefore, it is possible that hyperinsulinemic states such as obesity and metabolic syndrome may promote susceptibility to psoriasis or exacerbate existing psoriasis not only through their role in promoting inflammation, but also through increased and sustained levels of circulating VEGF[13].

7. Most of the psoriasis patients with moderate to severe disease get depression which develops into a vicious cycle with increased alcohol consumption, increased food intake and reduced physical activity, all aggravating the associated obesity and metabolic syndrome.

8. PSORS8 locus in psoriasis overlaps with Crohn's disease locus on long arm of chromosome 16[11]. There is a postulated role of bacteria in both of them and the response to therapy targeted at TNF-α[27].

9. Data from both animal and human studies suggest that the cytokines TNFα, IFN-γ and other Type I cytokines are linked to depression[28].

10. A study from Netherland states that the biological explanation for Osteoporosis in Psoriasis is increased levels of TNF-α[17].

Finally, genetics also play a critical role in susceptibility to psoriasis and metabolic disorders. Over 20 genetic loci containing varying numbers of genes, many of which have no known function, have been associated with psoriasis susceptibility. Of these, several are associated with susceptibility to metabolic diseases. The psoriasis susceptibility loci PSORS2, PSORS3, and PSORS4 are also associated with loci of susceptibility for metabolic syndrome, type 2 diabetes, familial hyperlipidemia and cardiovascular disease. Furthermore, individual genes associated with psoriasis such as CDKAL1, are also associated with type 2-diabetes. Genes with known function in cardiovascular risk, such as the ApoE4 isoform of ApoE are significantly more prevalent in chronic plaque and guttate psoriasis than in controls[13].

CARDIOVASCULAR DISEASES

In present days, attention is given to the association between psoriasis, cardiovascular risk factors and myocardial infarction[24,29,30,31,32,33]. The cardiovascular risk factors of hypertension, diabetes mellitus, obesity, smoking and dyslipidemia have been found to be more prevalent in patients with psoriasis[24,30,34,35]. Obesity and diabetes have been shown to be more prevalent in severe disease than in patients with mild disease.

After controlling these cardiovascular risk factors, psoriasis confers an independent risk for myocardial infarction[24,36,37,38]. The increased risk seems to be higher in younger patients[35,39,40,41] and in severe disease[35,39,40,41,42] and it is due to the inflammatory nature of psoriasis causing inflammatory change in coronary arteries[43].This leads to increased mortality compared with those without psoriasis[24,44].

The age adjusted proportion of atherosclerosis is significantly higher in psoriatic patients[45] and there is an association between atherosclerosis and the use of phototherapy. Traditional systemic antipsoriatic agents negatively affect cardiometabolic comorbidities and have an important interactions with drugs commonly used in psoriasis patients[46].

Methotrexate therapy for psoriasis has significantly reduced the risk for vascular disease. Concomitant use of folic acid with methotrexate

reduces the risk further. Low to moderate cumulative dose of methotrexate appears to be more beneficial than the higher dose[47].Hence patients with psoriasis should be treated effectively and encouraged to correct their modifiable cardiovascular risk factors[46].

Hyperuricemia that occurs in psoriasis is also an independent risk factor for cardiovascular disease and ischaemic storke[48].

CEREBROVASCULAR AND PERIPHERAL VASCULAR DISEASES

Since atherosclerosis is a systemic disease, it is reasonable to assume that if myocardial infarction is increased in patients with psoriasis, other manifestations of atherosclerosis, such as cerebrovascular disease and peripheral arterial disease might also be increased[24,49]. Stroke is a leading cause of mortality, and many of those who are fortunate enough to survive are left with a functional disability. Peripheral arterial disease, which can cause symptomatic claudication and may lead to amputation, is also associated with an increased risk of cerebrovascular disease, myocardial infarction and death[24].

A cross-sectional study was done with 32 severe psoriasis patients (defined as >10 year history of plaque-type psoriasis verified by a dermatologist and with >2 episodes of systemic or inpatient treatment) and 32 matched outpatient controls, to see the prevalence of coronary artery disease using spiral computed tomography to measure coronary

artery calcification. Severe psoriasis patients had a higher prevalence of coronary artery disease (CAD) compared with controls (59% vs. 28% respectively, $P = 0.02$), and had more severe CAD based on the coronary artery calcification scores[13].

A population-based cohort study of greater than 1,30,000 patients with psoriasis in the UK demonstrated an increased relative risk of myocardial infarction (MI), even after controlling the major cardiovascular risk factors. In particular, younger patients with severe psoriasis (defined as having received systemic psoriasis treatment) had the highest relative risks for MI. For example, a 30-year-old patient with severe psoriasis had a 3.1 (95% CI: 2.0-4.9) relative risk of MI, whereas a 60-year-old patient with severe psoriasis had a 1.36 (95% CI:1.1-1.6) relative risk[13].

In a study conducted at U.K., among 44,164 psoriasis cohort, 596 (1·4%) patients were having myocardial infarction and among the 2,19,784 comparison cohort, 2459 (1·1%) had myocardial infarction. This states that psoriasis patients are 1.21 times increased risk of getting myocardial infarction when compared to controls[50].

Multivariate analysis was done by Srjdan Prodanovich et.al, with 3236 psoriasis patients and 2500 patients without psoriasis (controls) to determine the association of psoriasis with vascular diseases. After age, sex and history of hypertension, diabetes, dyslipidemia and smoking

status were matched, patients with psoriasis had significantly high rate of atherosclerosis than the controls (OR: 2.18; 95% CI: 1.59-3.01). Patients with psoriasis were also more likely to have a diagnosis of ischemic heart disease (OR: 1.78; 95% CI: 1.51-2.11), cerebral vascular disease (OR: 1.70; 95% CI: 1.33-2.17), or peripheral arterial disease (OR: 1.98; 95% CI: 1.38-2.82)[24].

METABOLIC SYNDROME

Metabolic Syndrome is also known as syndrome X or insulin resistance syndrome. It describes a constellation of metabolic derangements that includes insulin resistance, hypertension, dyslipidemia (low HDL and elevated Triglycerides), central or visceral obesity, type 2 diabetes, impaired fasting glucose / impaired glucose tolerance and accelerated cardiovascular disease[51,52,53,54].

A study conducted by Christophers, E. et.al., with 600 psoriatic patients, supports the concept that psoriasis patients are at risk of obesity, hypertension and diabetes as well as dyslipidemia and chronic heart disease. Taken together there is accumulating evidence that, similar to Rheumatoid arthritis patients, psoriatic patients tend to develop signs of systemic disease known as metabolic syndrome[4].

As per the National Cholesterol Education Programme's Adult Panel III (ATP III), Metabolic syndrome is clinically identified by its risk

factors. Any three of the following risk factors to be present for the clinical diagnosis of metabolic syndrome[25,30].

No.	Risk Factor	Defining level
1.	Abdominal obesity Men (Waist circumference) Women (Waist circumference)	 > 102 cm (>40 inches) > 88 cm (>35 inches) Or specific medication
2.	Triglycerides	> 1.7 mmol/L (>150 mg/dl) Or specific medication
3.	HDL Men Women	 < 1.0 mmol/L (<40 mg/dl) < 1.3 mmol/L (<50 mg/dl) Or specific medication
4.	Blood Pressure	≥ 130/85mmHg Or specific medication
5.	Fasting Glucose	>100mg/dl

The presence of abdominal obesity is more highly correlated with metabolic risk factors than the elevated body mass index (BMI). Therefore a simple measure of waist circumference is recommended to identify the BMI component of the metabolic syndrome [55].

For measuring the waist circumference, the upper hip bone is located at first and the measuring tape is placed at the level of the upper most part of the hip bone around the abdomen (ensuing the tape measure was horizontal). The tape measure was snug but did not cause

compression on the skin. Venous samples can be taken after the subjects have been fasted overnight (at least 8 hours) to estimate the Serum cholesterol, triglycerides, HDL, LDL and Plasma glucose. Blood pressure can be recorded as the average of two measurements after subjects have been seated for about five minutes[25].

A study conducted by Safiye Kutlu et.al., by including 250 psoriatic patients (131 females, 119 males; age range: 18−85; mean age: 41.39 ± 14.7) states that metabolic syndrome was found in 30.8% of patients with psoriasis, and Type 2 psoriasis was more common in them[56].

Another study with 338 psoriasis cases and 334 controls, states a higher prevalence of metabolic syndrome in cases than in controls [30·1% vs. 20·6%, odds ratio (OR- 1·65, 95% CI -1·16 to 2·35; $P = 0·005$] after controlling for sex and age. The high prevalence of metabolic syndrome in psoriatic patients was confirmed in all age classes of 40 years and older. Metabolic syndrome was present in 35·2% of patients with psoriatic arthritis($P = 0·003$). Prevalence of metabolic syndrome was not correlated to severity of psoriasis, in particular, there was no difference in the prevalence of metabolic syndrome in patients with a PASI score lower or higher than 10 (30·1% vs. 29·4%, respectively; $P = 0·9$), or in patients with BSA involvement lower or greater than 10% (32·2% vs. 28·4%, respectively; $P = 0·4$). There were no differences in the prevalence of metabolic syndrome between men and women, but it was

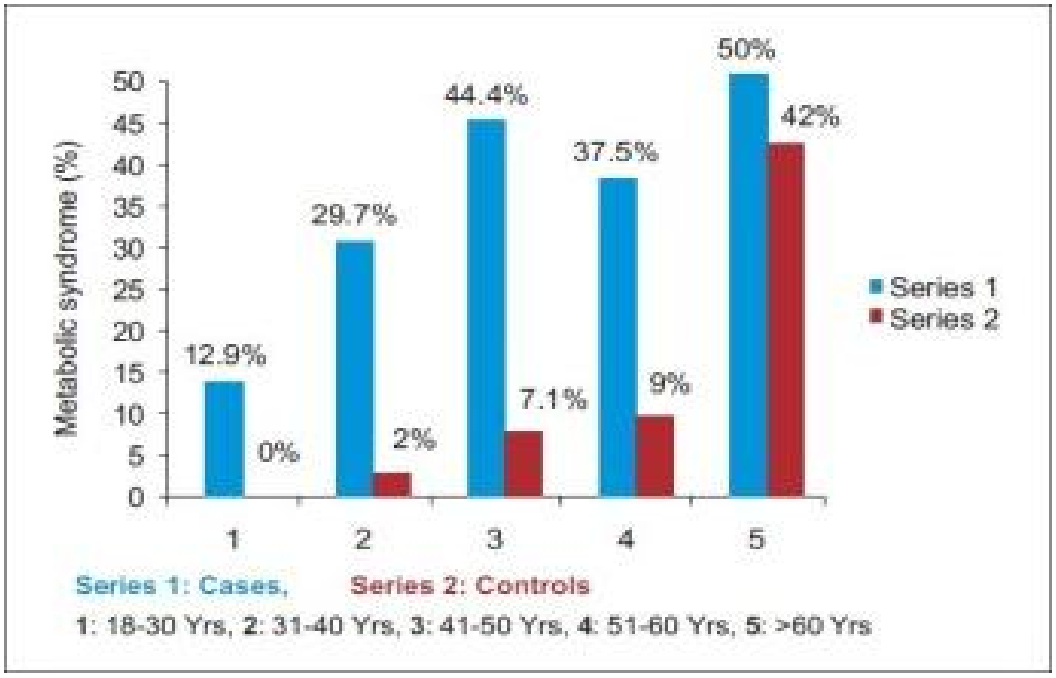
more frequent after the age of 40 in both cases and controls. Waist circumference > 102 cm in men or > 88 cm in women, and triglyceridaemia > 1·7 mmol L^{-1} were significantly more prevalent in cases than in controls. In contrast, there were no significant differences regarding the prevalence of low HDL cholesterol, hypertension and fasting plasma glucose between cases and controls. This study found a mild but significant correlation between severity of psoriasis and triglyceridaemia in patients with psoriasis (P = 0·04) and between plasma fasting glucose and triglyceridaemia in subjects with metabolic syndrome (P = 0·0006). This study found no significant correlation between psoriasis severity with waist circumference, blood pressure, fasting plasma glucose and body weight[57]. The higher prevalence of metabolic syndrome in patients with psoriasis[57,58], could play a relevant role in accelerating atherosclerosis[57].

But the relationship between metabolic syndrome and the severity of psoriasis is controversial. Sommer *et al.*, reported an increased prevalence of metabolic syndrome in patients with moderate-to-severe psoriasis. In contrast, Gisondi *et al.*, and Takahashi *et al.*, detected no correlation between the severity of psoriasis and metabolic syndrome. Again, it was demonstrated that the duration and severity of psoriasis has no effect on insulin resistance [56].

A study by Nuzhatun Nisa et.al included 150 chronic plaque psoriasis cases and 150 controls. A higher prevalence of metabolic

syndrome in cases (42/150= 28%) than in controls (09/150 = 6%) with an odds ratio (OR) of 6.09, $P < 0.05$ was found after adjusting for confounding by age. This study also observed the higher prevalence of individual components of metabolic syndrome like triglyceride levels >150 mg/dl (73/150 *vs* 24/150 OR= 4.98, P=0.0005), fasting plasma glucose > 100 mg/dl (27/150 *vs* 08/150 OR=3.90, p =0.0006) and blood pressure >130/85 (74/150 *vs* 24/150 OR=5.11, P=0.0005) in psoriasis patients than controls.

In all age groups they observed higher prevalence of metabolic syndrome among cases than controls. They also observed an early onset of metabolic syndrome in psoriasis. Comparative prevelance of metabolic syndrome among different age groups of cases and controls is shown below:



Such an association prompts us to look upon atherosclerotic and psoriatic plaques as closely related entity but the conclusion awaits establishment of a common or at least closely related etiopathogenetic mechanism [25].

Though few studies have directly evaluated the prevalence of metabolic syndrome in patients with psoriasis[59], various studies have evaluated the prevalence of individual components of this syndrome [13].

OBESITY

Obesity is defined as a body mass index (BMI) ≥ 30·0, while overweight is defined as a BMI of 25·0-29·9[22,30,60,61]. BMI can be calculated by weight in kilograms divided by the square of the height in metres[22,60,62]. Both obesity and overweight are associated with increased mortality. Body mass index(BMI) is a simple and commonly used index to find out obesity in adults[22,60].

In addition to the well-known associations between obesity and diabetes, hypertension, dyslipidemia, sleep apnoea, coronary heart disease and stroke, it has also been associated with psoriasis[22].Various studies have demonstrated that psoriasis patients are at risk of developing obesity.[12,13,39,57,63,64,65,66,67]

The association between psoriasis and obesity make psoriasis an important healthcare issue [43]. Furthermore obesity has been shown to be

an independent risk factor for the development of psoriasis, and it is associated with severe disease[13]. Psoriatic patients from urban areas and alcoholics are at the increased risk of obesity[68].

In a study conducted at U.K., among the 44,164 psoriasis cohort, 2760 (6·3%) patients had obesity and among the 2,19,784 comparison cohort, 11,996 (5·5%) had obesity. This study also says that psoriasis patients are 1.18 times increased risk of getting obesity when compared to controls[50].

In a study conducted at Israel, with 16,851 psoriasis patients and 48,681 controls, obesity was seen in 8.4% of patients and 3.6% of controls ($p<0.001$)[69].

DYSLIPIDEMIA

Several cross-sectional and case control studies demonstrate an association of psoriasis and dyslipidemia.[63,64,70,71]

Dyslipidemia is defined by presence of one or more abnormal serum lipid concentration. According to NCEP-ATP III Guidelines, hypercholesterolemia is defined as total cholesterol >200mg/dl, LDL as >100mg/dl, hypertriglyceridemia as TGL >150mg/dl and HDL <40mg/dl[72,73].

In a study conducted at U.K., among the 44,164 psoriasis cohort, 1900 (4·3%) patients had hyperlipidemia and among the 2,19,784

comparison cohort, 8111 (3·7%) had hyperlipidemia. According to this study psoriasis patients are 1.17 times more prone for hyperlipidemia when compared to controls[50].

In a hospital clinic based cross-sectional study in Iran, psoriasis patients (mean BSA 42%) were shown to have significantly higher mean levels of triglycerides, total cholesterol, LDL and VLDL but no alteration in HDL[74]. Another study conducted by Zari Javidi et.al., also supported the same[75].

A cross-sectional study of 84 psoriatic patients attending an outpatient hospital based clinic in Turkey compared with 40 age and sex matched healthy controls from the community demonstrated an higher mean total cholesterol, triglycerides, and LDL in the psoriasis patients than controls[76]

A study was done in Hyderabad with 79 psoriasis patients and 79 controls, to analyse the lipid profile in psoriasis patients having less than 30% Body surface area involvement. It stated that serum cholesterol, triglycerides and LDL cholesterol were significantly higher in psoriasis patients and there was no significant statistical difference between VLDL and HDL between patients and control group[77].

Various studies have failed to find consistent associations of psoriasis with dyslipidemia. A cross-sectional study of 30 psoriasis patients (mean PASI 10.0) attending a hospital based outpatient clinic in

Iran compared with 30 sex, age, and BMI matched healthy controls found no association between psoriasis and alteration in fasting blood sugar, triglycerides, total cholesterol, LDL, HDL and VLDL [(78)].

In addition, a case-control study of 200 recent onset predominantly mild psoriasis patients attending a dermatology clinic in Stockholm and 285 community based controls supports the concept that lipid abnormalities in psoriasis may be genetically determined rather than acquired [(79)].

HYPERTENSION

Hypertension, defined as a blood pressure of > 140/90 mmHg, is extremely common worldwide[(22,80)].

When Hypertension is suspected, Blood pressure should be measured atleast twice during 2 separate examinations after the initial screening. If the average of $\geq$2 readings is $\geq$140/90mmHg then the patient is considered as Hypertensive[(81,82)]. The level of systolic pressure is more important to assess the influence of arterial pressure on cardiovascular morbidity[(81)].

Studies states that cardiovascular risk begins at a blood pressure of >115/75 mmHg and doubles with each increment of 20/10 mmHg. The higher the blood pressure, the greater is the risk of stroke, myocardial infarction, heart failure and kidney failure. Clinical trials have shown that

treatment of hypertension lowers the risk of developing heart failure by more than 50%, risk of stroke by 35-40%, risk of myocardial infarction by 20-25%. Current treatment guidelines suggest that treatment can be initiated when the blood pressure is ≥ 140/90 mmHg for nondiabetics and ≥ 130/80 for those with diabetes or renal disease[22].

Several studies have demonstrated increased risk of hypertension in psoriasis[13,18,19,57,63,70,83,84] and it occurs more commonly in alcoholics and smokers[68].

In a study conducted at U.K., among the 44,164 psoriasis cohort, 2765 (6·3%) patients had hypertension and among the 2,19,784 comparison cohort, 12,754 (5·8%) had hypertension. According to this study psoriasis patients are 1.09 times more prone for hypertension when compared to controls[50].

In a study conducted at Israel, with 16,851 psoriasis patients and 48,681 controls it is found that hypertension was present in 27.5% of patients and 14.4% of controls ($p<0.001$) [69].

DIABETES MELLITUS

The National Diabetes Data group and World Health Organization diagnostic criteria for Diabetes mellitus is as follows:

Criteria for the diagnosis of Diabetes mellitus :

Symptoms of diabetes plus random blood glucose concentration $\geq$ 11.1 mmol/L (200 mg / dl)

or

Fasting plasma glucose $\geq$ 7.0 mmol/L (126 mg / dl)

or

Two-hour plasma glucose $\geq$ 11.1 mmol/L (200 mg / dl) during an oral glucose tolerance test.

The revised criteria for diagnosis emphasize that the Fasting plasma glucose is a reliable and convenient test for diagnosing Diabetes mellitus in asymptomatic individuals. A random plasma glucose concentration > 11.1 mmol/L accompanied by classic symptoms of diabetes mellitus (polyuria, polydipsia, weight loss) is sufficient for the diagnosis of diabetes mellitus. Oral glucose tolerance testing, though still a valid mechanism for diagnosing Diabetes mellitus, is not recommended as a part of routine care[85].

When compared to national estimates, psoriatic patients have increased risk of diabetes mellitus, hypertension, heart disease and emphysema[19].

Many cross-sectional and case control studies have observed an increased prevalence of diabetes in patients with psoriasis. [45,62,63,64,70,84,86,87,88,89,90,91] Diabetes mellitus was common in

psoriasis patients aged above 40 years[88] and statistically significant associations between psoriasis severity and markers of insulin resistance (insulin secretion and serum resistin) was found[92].

A cross sectional study was done in Israel, to know the association between psoriasis and metabolic syndrome. It demonstrated that psoriasis was associated with diabetes, hypertension etc. after adjusting for age, gender, smoking with odds ratio and 95% confidence interval as follows[69].

Disease	Odds ratio	95% confidence Interval
1. Diabetes	1.2	1-1.3
2. Hypertension	1.3	1.2-1.5
3. Metabolic syndrome	1.3	1.1-1.4
4. Obesity	1.7	1.5-1.9
5. Ischaemic heart disease	1.1	1.0-1.2

In a study conducted at U.K., among the 44,164 psoriasis cohort, 1198 (2·7%) patients had diabetes and among the 2,19,784 comparison cohort, 4482 (2·0%) had diabetes. This study states that psoriasis patients are 1.33 times more prone for diabetes mellitus when compared to controls[50].

The risk of diabetes mellitus was high with increased severity[63] and duration of psoriasis[26]. The increased incidence in severe disease may be due the use of very potent topical steroids or systemic medications for psoriasis[45].

GASTRO ESOPHAGEAL REFLUX DISEASE

Obesity is common in psoriasis and this is implicated as a risk factor for Gastro esophageal reflex disease and colorectal carcinoma[93].

INFLAMMATORY BOWEL DISEASE

The prevalence of both crohn's disease and ulcerative colitis are significantly higher in Psoriasis [94]. The family history of psoriasis is frequently observed in patients with crohn's disease[20].

NAFLD (NON – ALCOHOLIC FATTY LIVER DISEASE)

Non-alcoholic fatty liver disease (NAFLD) encompasses conditions ranging from simple fatty liver to non-alcoholic steatohepatitis (NASH), which can finally give rise to fibrosis and cirrhosis. NAFLD is mainly due to an underlying insulin-resistant state which is a feature of the metabolic syndrome. As metabolic syndrome is found to be associated with both psoriasis and NAFLD, it is likely that both entities can coexist in the same patient. It is found that psoriatic patients with NAFLD are more likely to develop progressive liver disease such as NASH and fibrosis.

An increase in the visceral adipose tissue seen in psoriatic patients results in the release of multiple factors such as free fatty acids, hormones and adipocytokines which in turn lead to the development of inflammation, insulin resistance and NAFLD.

NAFLD as such can also cause the release of mediators such as reactive oxygen species , C-reactive protein, interleukin (IL)-6 and other proinflammatory cytokines from the liver which in turn contribute to the severity of psoriasis[95]. Imaging techniques such as USG, CT and MRI will yield alterations suggesting increased fat in the liver[96].

It is frequently seen in patients with chronic plaque psoriasis, affecting upto nearly half of these patients and is strongly associated with psoriasis severity [14]. NAFLD in psoriasis patients have significant correlation with metabolic syndrome, obesity, hypercholesterolemia, hypertriglyceridemia, AST/ALT >1 and psoriatic arthritis. So early recognition of NAFLD by radiological imaging tests in this group of patients is warranted especially when potentially hepatotoxic drug therapy is being considered[97].

CHRONIC OBSTRUCTIVE PULMONARY DISEASE (COPD)

The prevalence of COPD is significantly higher in psoriasis and it is also associated with metabolic syndrome. Therefore it is important to advise them to stop smoking, to reduce the additional risk factors of COPD[98].

DEPRESSION AND QUALITY OF LIFE IN PSORIASIS

Psoriatic patients suffer from Psychological distress especially as a result of stigmatization, self consciousness and embarrassment, which inturn affect their employment and social activities. Relatively higher rates of depression is reported in psoriasis[9,28]. Adjustment disorder and dysthymia have also been reported [99] and it seems that patients complaining of pruritis frequently have anxiety disorder. Social and occupational functioning worsened with increasing severity of psoriasis after one year duration of illness[100].

MALIGNANCY

Patients with psoriasis are at risk of developing malignancy, particularly non- melanoma skin cancer and lymphoproliferative cancers[9].The risk is greater in severe disease and it probably reflects those treated with systemic agents and phototherapy[20].

AIM OF THE STUDY

1. To find out the comorbidities that occur in psoriasis

2. To study the prevalence of these comorbidities

3. To correlate the comobidities with clinical parameters like age, sex, duration of disease, type of psoriasis and severity.

MATERIALS AND METHODS

Study design

Descriptive study

Study centre

Department of Dermatology and Leprosy, Rajiv Gandhi Government General Hospital, Chennai

Study period

October 2009 to September 2011 (2 years)

Inclusion criteria

Cases of psoriasis proven by clinical examination or by biopsy

Exclusion criteria

- Patients on systemic management for psoriasis
- Patients who were not willing to undergo investigations as per the study protocol

Sample size

- A total of 171 patients were included in the study

- All patients were explained about the disease and the benefits of being participating in this study.

- Consent was obtained from all the patients for participating in this study. For children consent was obtained from their parents.

Data collection

It was done as per the proforma.

All patients were evaluated as follows:

1. History
2. General examination
3. Systemic examination
4. Dermatological examination
5. Investigations
6. Speacialist opinions

History

The detailed history about the patients and regarding their disease were collected. Importance was given to the particulars like

1. Age
2. Sex
3. Duration of disease
4. Area of skin involved

5. History of comorbidities like Diabetes mellitus, Hypertension etc.,
6. History of comorbidities in their family
7. History of alcoholism
8. Treatment history

General Examination

- A complete and thorough examination was done in all patients.
- Blood pressure was recorded.
- Waist circumference was measured in cm in all, at the level of iliac crest with the tape snuggly fitting on the skin and it was recorded.
- Height and weight of the patients were measured and recorded.
- Body mass index (BMI) was calculated using the following formula: Weight (kg) / Height (m^2)

Systemic Examination

The following systems were examined:

- Cardiovascular System
- Respiratory System
- Abdomen
- Central nervous System

Dermatological Examination

A thorough examination of skin lesions were done

I. To identify the type of psoriasis

II. To assess the severity by PASI(Psoriasis Area Severity Index) score

PASI score

Severity of Erythema (E), Desquamation (D) and Induration (I) was recorded on a 5 point scale as follows:

0 - Nil

1 - Mild

2 - Moderate

3 - Severe

4 - Very Severe

The area of involment was recorded on a 7 point scale as follows:

0 - Nil

1 - <10%

2 - 10% - 29%

3 - 30% - 49%

4 - 50% - 69%

5 - 70% - 89%

6 - 90% - 100%

PASI was calculated as follows

$$PASI = 0.1(E_H+I_H+D_H)A_H +0.2\ (E_U+I_U+D_U)A_U + 0.3\ (E_T+I_T+D_T)A_T +0.4\ (E_L+I_L+D_L)A_L$$

A - Area

H - Head

U - Upper Limb

T - Trunk

L - Lower Limb

Those patients whose PASI >10, erythrodermic and pustular psoriasis were considered to have severe disease.

Investigations

The Fasting blood sample was obtained from all the participants for the estimation of the following parameters:

1. Fasting plasma glucose
2. Serum Cholesterol
3. Serum Triglycerides
4. Serum High density lipoprotein (HDL)
5. Serum Low density lipoprotein(LDL)

In addition, Electrocardiogram,

Ultrasonogram abdomen,

Chest X-ray were taken in all the participants.

Other investigations like

Complete blood counts,

Liver function tests,

Renal function tests were done for treatment purpose.

Specialist Opinions

If there were any abnormality in the above parameters, concerned specialist opinion like

Diabetologist opinion

Medical opinion

Cardiologist opinion

Gastroenterologist opinion etc., were sought and the instructions were followed.

Analysis

It was done using statistical package for social sciences (SPSS) version 16.0

OBSERVATIONS AND RESULTS

Comorbidities

Among the total 171 patients studied 123 (71.93%) patients were having comorbidities (Fig.1)

Number of comorbidities (Fig.2)

- One comorbidity was seen in 82 patients (47.95%)
- Two comorbidities were seen in 25 patients (14.62%)
- More than two comorbities were seen in 16 patients (9.36%)

Dyslipidemia was the major component in those with 2 comorbidities. This was observed in combination with hypertension commonly, followed by myocardial infarction, diabetes mellitus and obesity in the order of frequency.

Most of the patients with more than two comorbidities had metabolic syndrome.

Various comorbidities (Fig.3)

The comorbidities seen in our study were as follows:

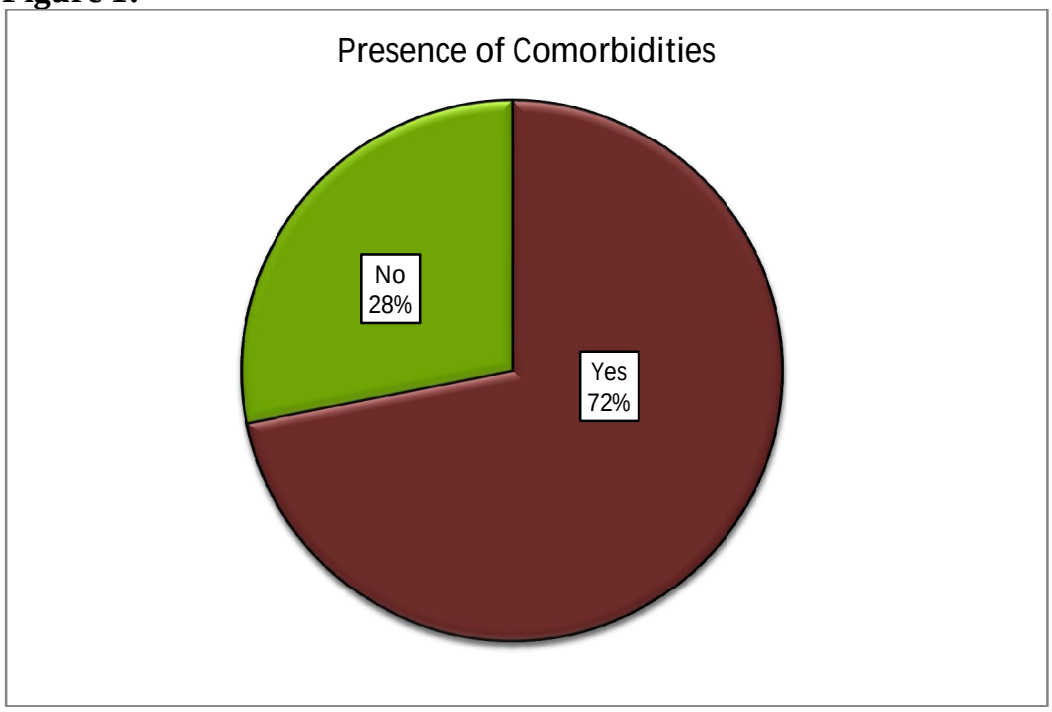
Comorbidities	Number of patients		Percentage
	Total	Comorbidities	
Hypertension(HT)	171	26	15.20%
Obesity(OB)	171	11	6.43%
Diabetes mellitus(DM)	171	16	9.36%
Dyslipidemia(DYS)	171	112	65.50%
Metabolic syndrome(MS)	171	15	8.77%
Myocardial infarction(MI)	171	8	4.68%

Age distribution (Fig.4)

The age of psoriatic patients having comorbidities varies from 10 to 70 years and the distribution was as shown in the table below

Age in years	Number of patients		Comorbidities	Percentage
	Total	Comorbidities		
1-10	5	2	DYS	40%
11-20	22	14	DYS	63.64%
21-30	30	19	DYS, HT, OB, DM	63.33%
31-40	35	26	DYS, OB, DM, MS, HT	74.29%
41-50	33	27	DYS, HT, MS, MI, OB, DM	81.82%
51-60	32	25	DYS, HT, DM, MS, OB, MI	78.13%
> 60	14	10	DYS, HT, MS, DM, MI	90.91%

Figure 1:



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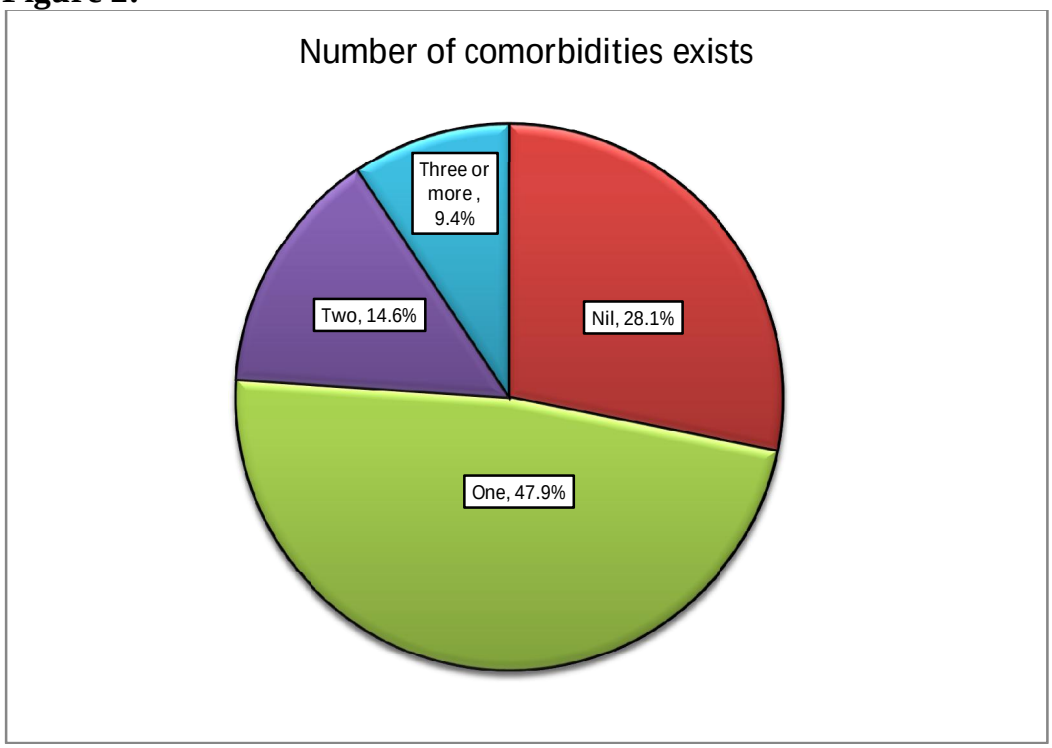

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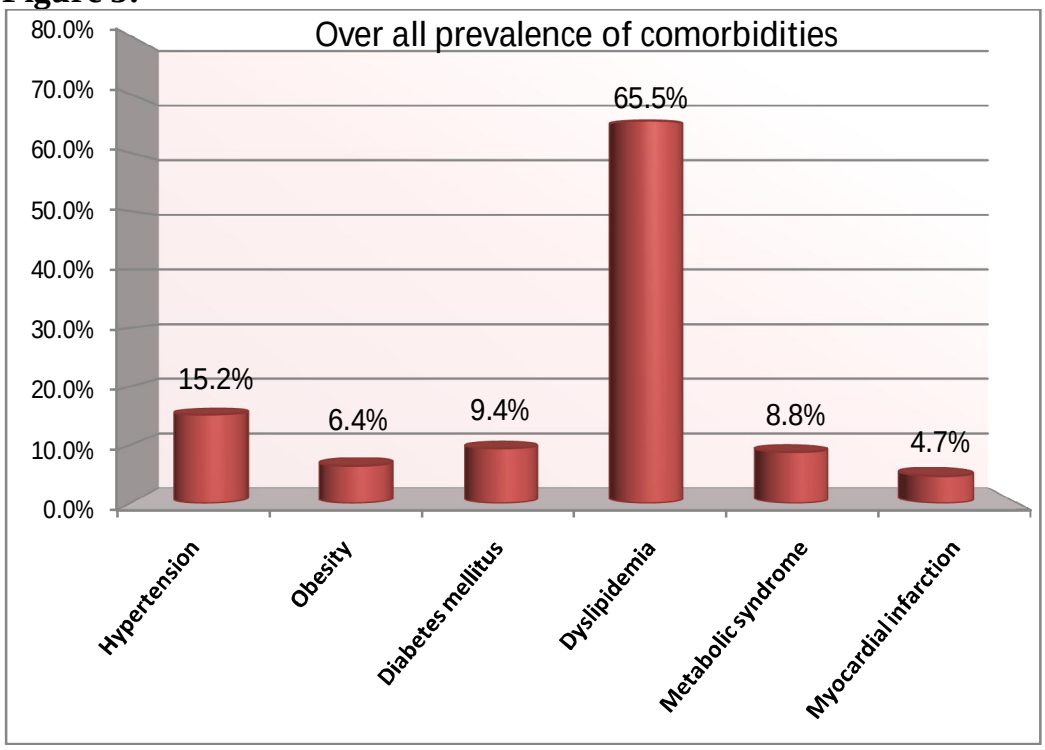

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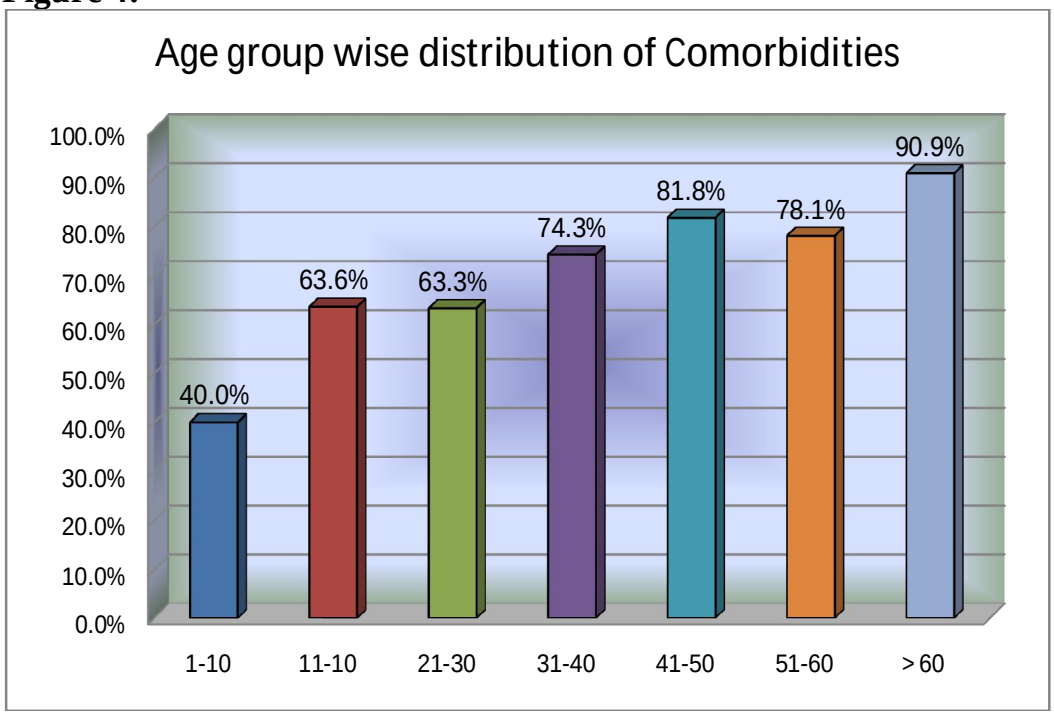


Sex distribution (Fig.5)

Male patients outnumbered the female patients in this study and the distribution was as shown in the table

Sex	Number of patients		Comorbidities	Percentage	p-value
	Total	Comorbidities			
Males	107	74	DYS, HT,MS,DM, MI,OB	69.16%	0.2987
Females	64	49		76.56%	

Duration of disease (Fig.6)

Duration of psoriasis in patients having comorbidities varies from 10 days to 26 years.

Duration in years	Number of patients		Percentage	p-value
	Total	Comorbidities		
Upto 5	143	100	69.93%	0.1887
Above 5	28	23	82.14%	

Figure 5:

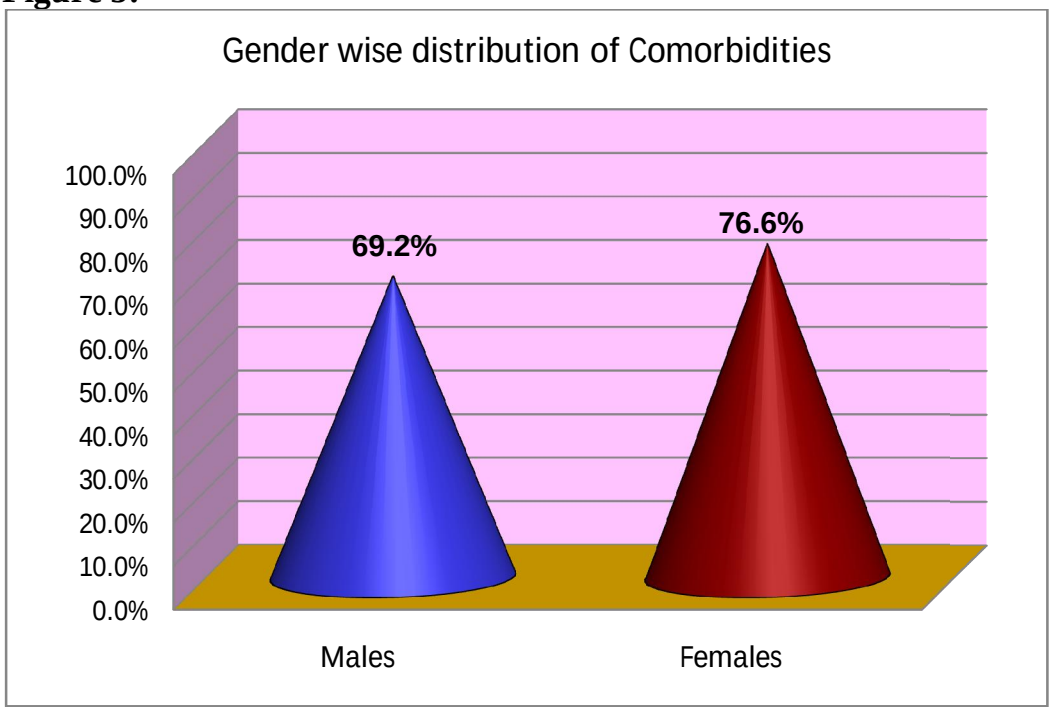
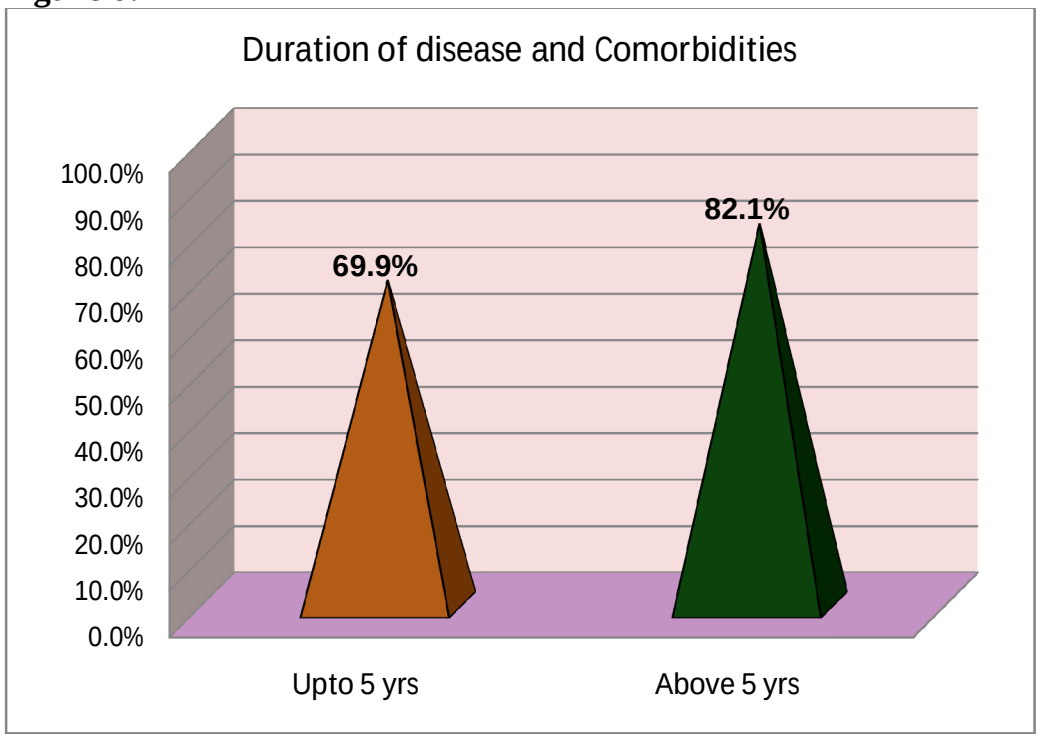


Figure 6:



History of comorbidities

Only 17 (9.94%) of our patients were diagnosed to have comorbidities while presenting to us of whom 7 (4.09%) had developed comorbidities before psoriasis. Among them 5 patients were prescribed β blockers and ACE inhibitors for their comorbidities (Hypertension). As these drugs were supposed to precipitate or aggravate psoriasis, alternative drugs were prescribed for them.

27 patients gave history of one or other comorbidities running in their family. They gave history that diabetes mellitus, hypertension, myocardial infarction were running in their families but not dyslipdemia or obesity. 24 among these 27 patients had comorbidities. Most of them had different comorbidities when compared to their family members.

Type of disease (Fig.7)

Comorbidities seen in each type of psoriasis is given in the table.

Type	Number of patients		Comorbidities	Percentage
	Total	Comorbidities		
Psoriasis Vulgaris (PASI <10)	40	26	DYS,HT,MS, DM,MI	65%
Psoriasis Vulgaris (PASI >10)	40	34	DYS,HT,DM, MS,OB,MI	85%
Palmoplantar psoriasis	35	26	DYS,HT,MS, DM,OB	74.29%
Erythrodermic psoriasis	20	9	DYS,DM,MI, OB,HT,MS	45%
Pustular psoriasis	14	11	DYS,HT,MS, DM,OB,MI	78.5%
Guttate psoriasis	22	17	DYS,OB	77.27%

Severity (Fig.8)

The distribution of comorbidities with respect to severity of the disease is given here.

Severity	Number of patients		Percentage	p-value
	Total	Comorbidities		
Mild or Moderate	94	66	70.21%	0.5809
Severe	77	57	74.02%	

Figure 7:

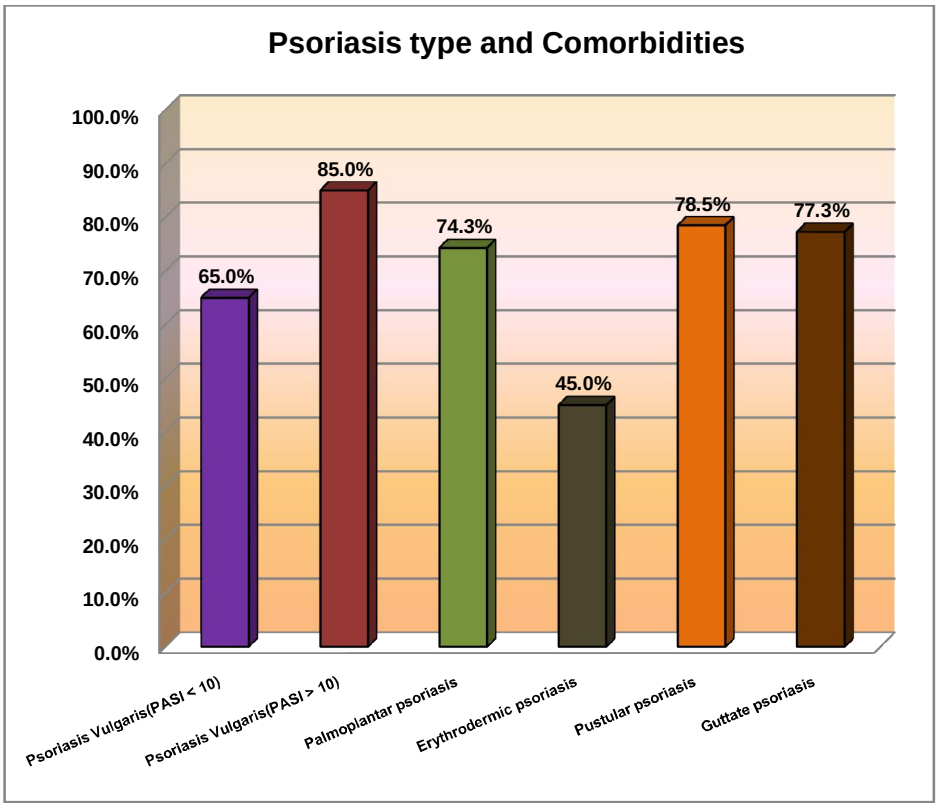
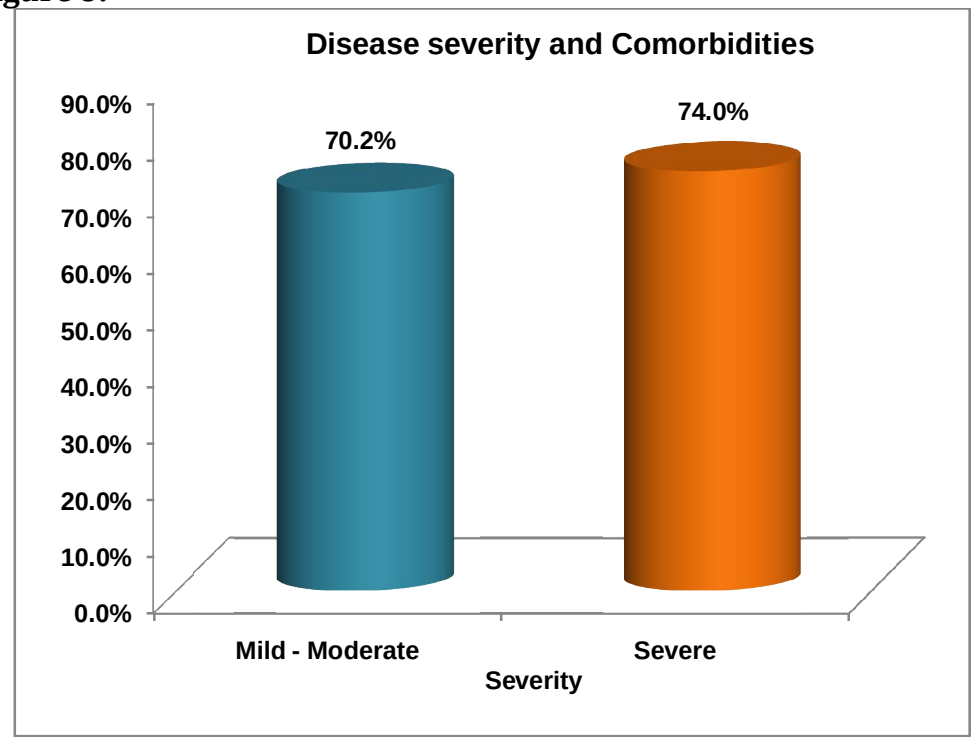


Figure 8:



HYPERTENSION

This was present in 26(15.2%) out of 171 patients.

Their age distribution(Fig.9) varies from 29 to 70 years. 2 of the patients in the group of upto 40 years, were of age 29 and 40.

Age in years	Number of patients		Percentage	p-value
	Total	Hypertension		
Upto 40	92	2	2.17%	<0.001
Above 40	79	24	30.38%	

Sex distribution(Fig.10) of patients with hypertension was shown in the table below

Sex	Number of patients		Percentage	p-value
	Total	Hypertension		
Males	107	15	14.01%	0.5765
Females	64	11	17.18%	

Duration of psoriasis in patients with hypertension varies from 1 month to 20 years and it is shown in figure 11.

Hypertension is seen in palmoplantar psoriasis , psoriasis vulgaris, pustular type, erythrodermic psoriasis in the decreasing order of frequency. The distribution (Fig. 12) is given here

Type	**Number of patients**		**Percentage**
	Total	**Hypertension**	
Psoriasis Vulgaris (PASI <10)	40	**7**	17.50%
Psoriasis Vulgaris (PASI >10)	40	8	20%
Palmoplantar psoriasis	35	8	22.85%
Erythrodermic psoriasis	20	1	5%
Pustular psoriasis	14	2	14.28%
Guttate psoriasis	22	0	0%

Severity of the disease in patients with hypertension is given here.

Severity	**Number of patients**		**Percentage**	**p-value**
	Total	**Hypertension**		
Mild or Moderate	94	15	15.95%	0.3810
Severe	77	11	14.28%	

Figure 9:

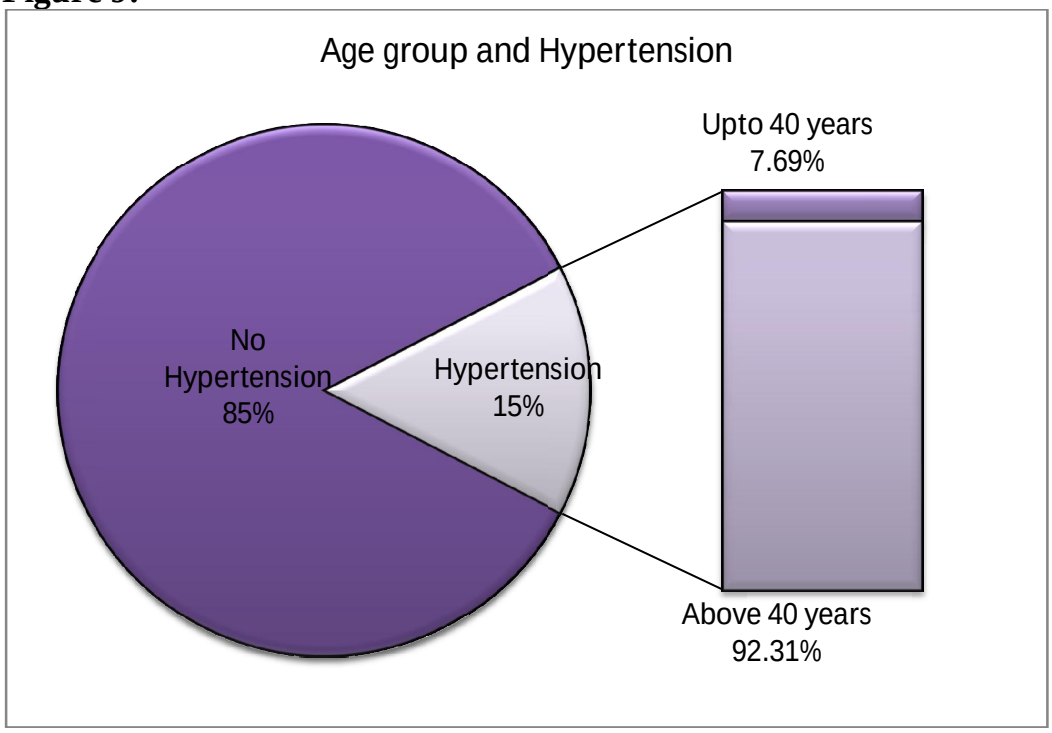
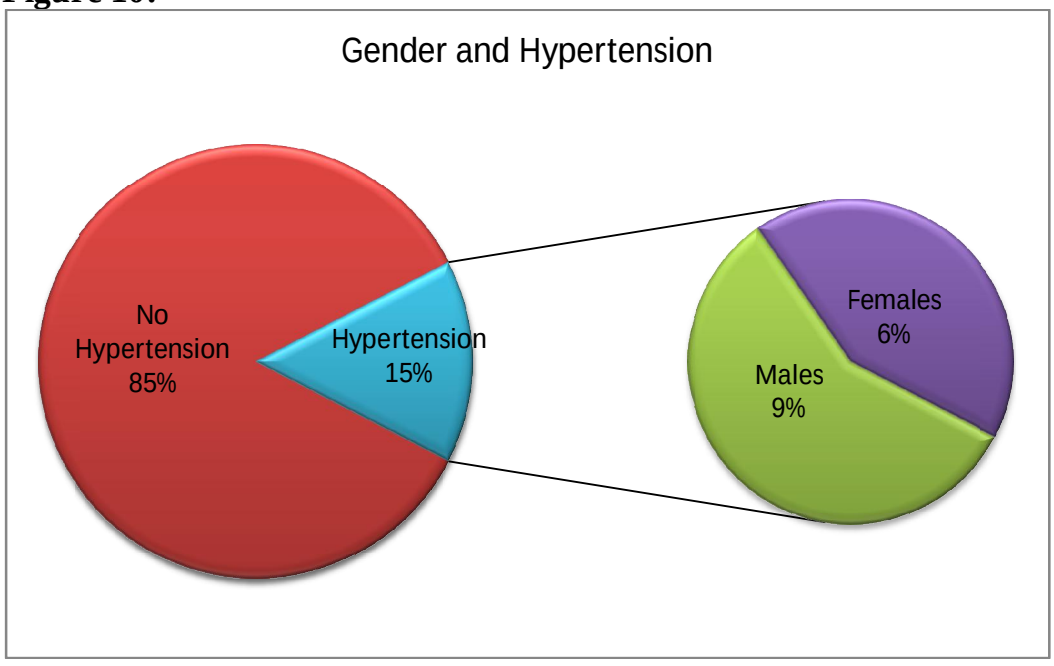


Figure 10:



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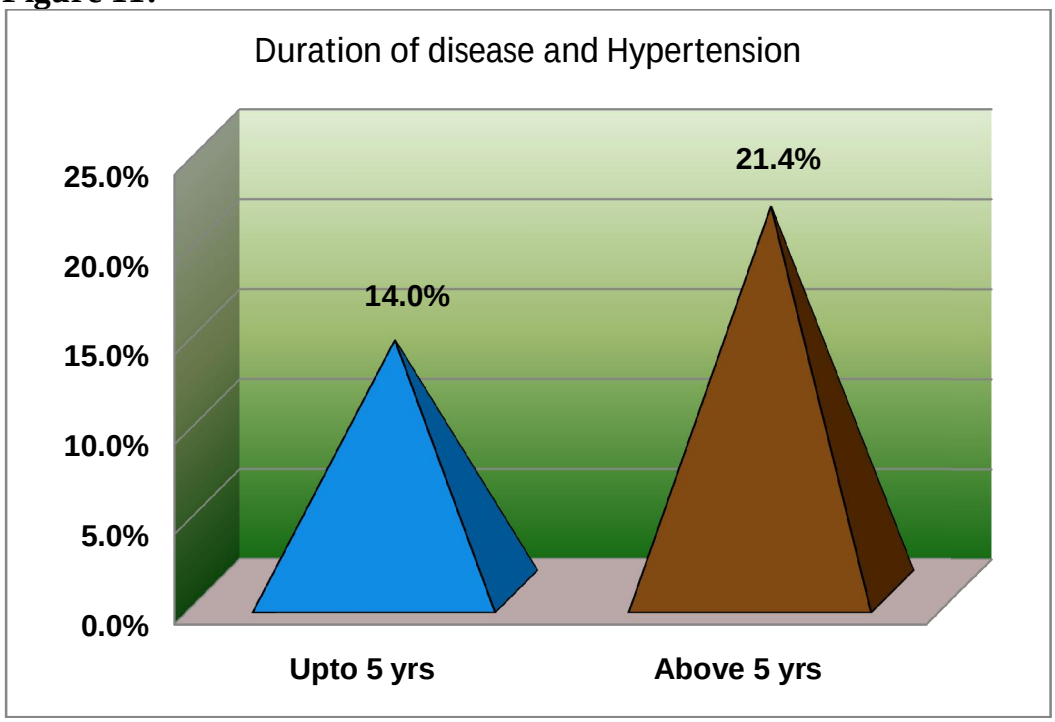
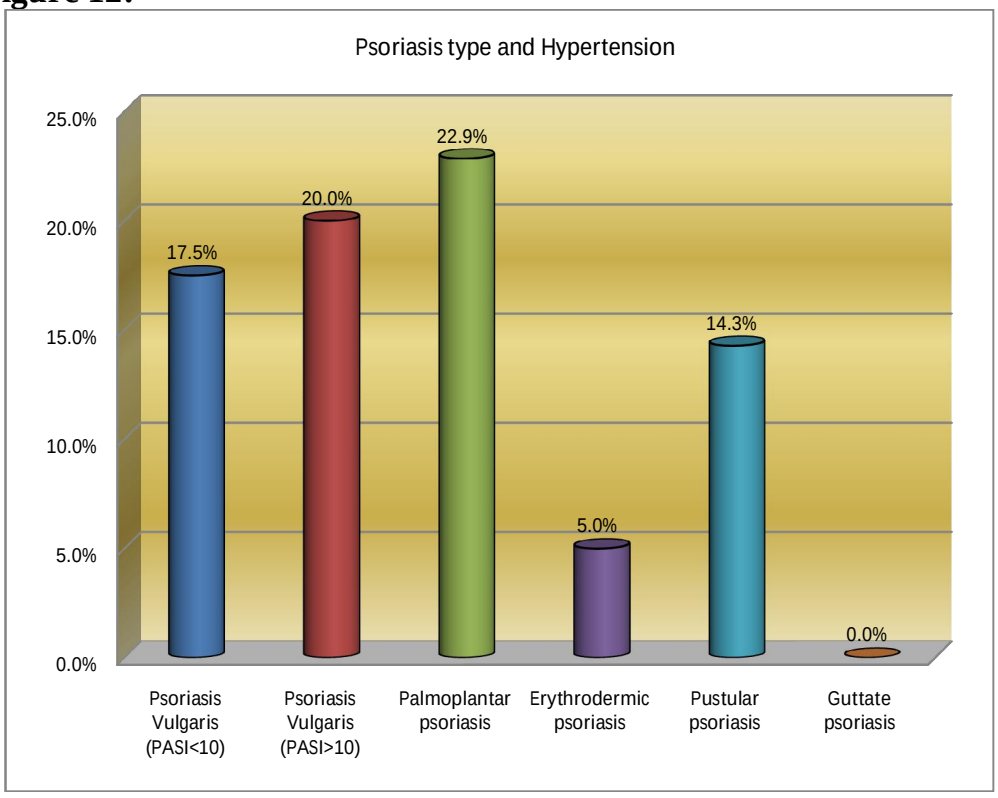


Figure 12:



OBESITY

This was present in 11(6.43%) out of 171patients.

Their age distribution (Fig.13) was from 28 to 56 years.

Age in years	Number of patients		Percentage	p-value
	Total	Obesity		
Upto 40	92	4	4.35%	0.2310
Above 40	79	7	8.86%	

Sex distribution (Fig.14) of patients having obesity was shown below

Sex	Number of patients		Percentage	p-value
	Total	Obesity		
Males	107	7	6.54%	0.9390
Females	64	4	6.25%	

Duration of psoriasis in them varies from 1 month to 20 years and it is shown in figure 15.

Obesity is common in erythrodermic psoriasis followed by guttate psoriasis, psoriasis vulgaris (PASI >10), pustular type, palmoplantar

psoriasis, psoriasis vulgaris (PASI <10) in the decreasing order of frequency. The distribution (Fig.16) is shown below.

Type	Number of patients		Percentage
	Total	Obesity	
Psoriasis Vulgaris (PASI <10)	40	1	2.5%
Psoriasis Vulgaris (PASI >10)	40	3	7.5%
Palmoplantar psoriasis	35	2	5.71%
Erythrodermic psoriasis	20	2	10%
Pustular psoriasis	14	1	7.14%
Guttate psoriasis	22	2	9.09%

Severity of psoriasis in obese patients is given below

Severity	Number of patients		Percentage	p-value
	Total	Obesity		
Mild or Moderate	94	5	5.31%	0.256
Severe	77	6	7.79%	

In addition 29(16.96%) patients were preobese who were at risk of developing obesity in future. Their age varies from 13 to 62 years.

Figure 13:

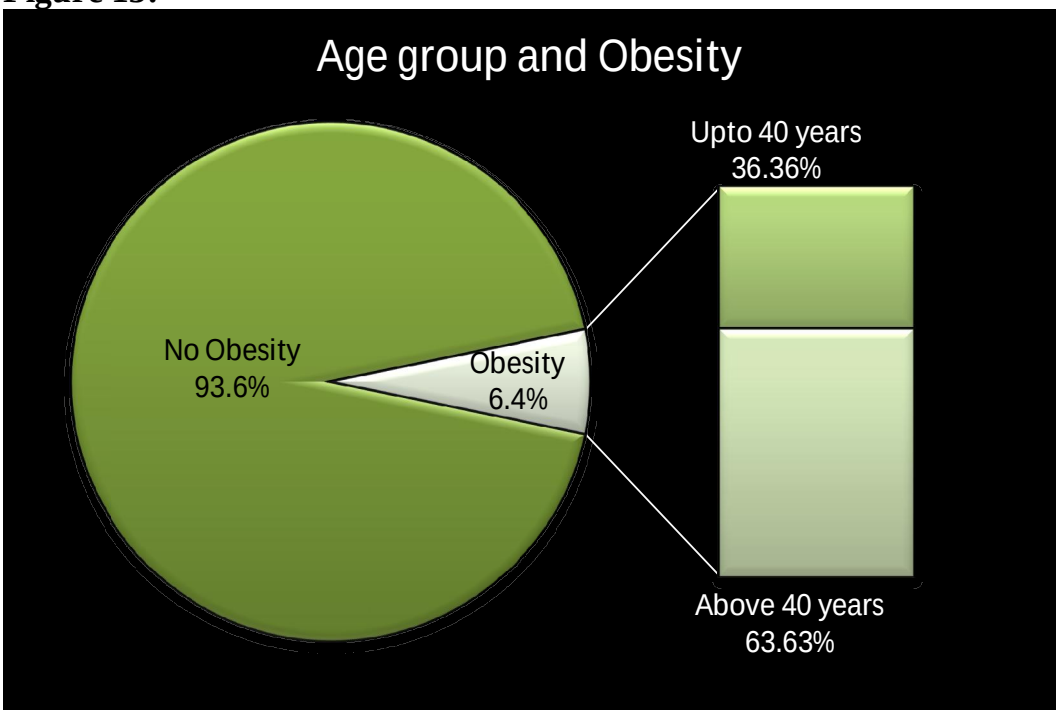


Figure 14:

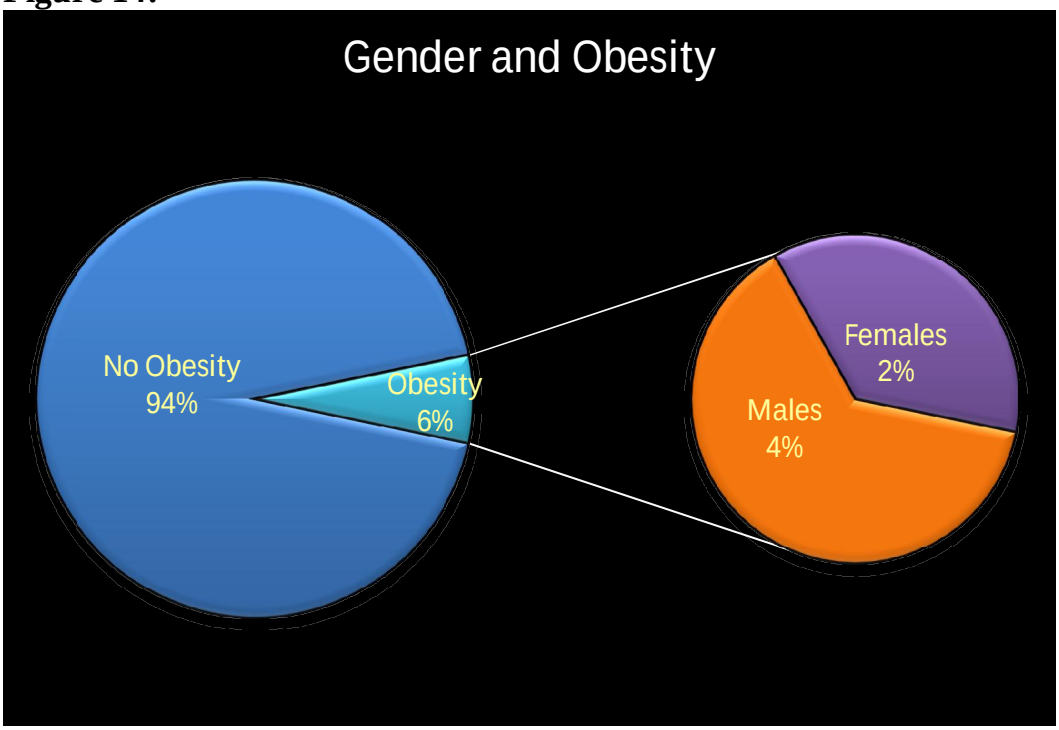


Figure 15:

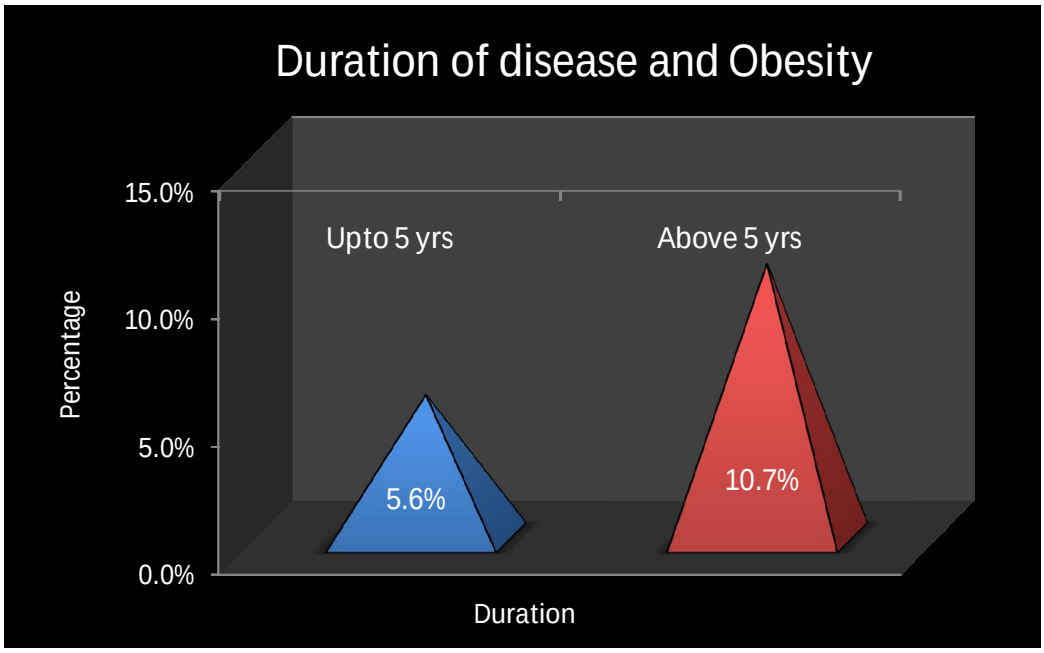
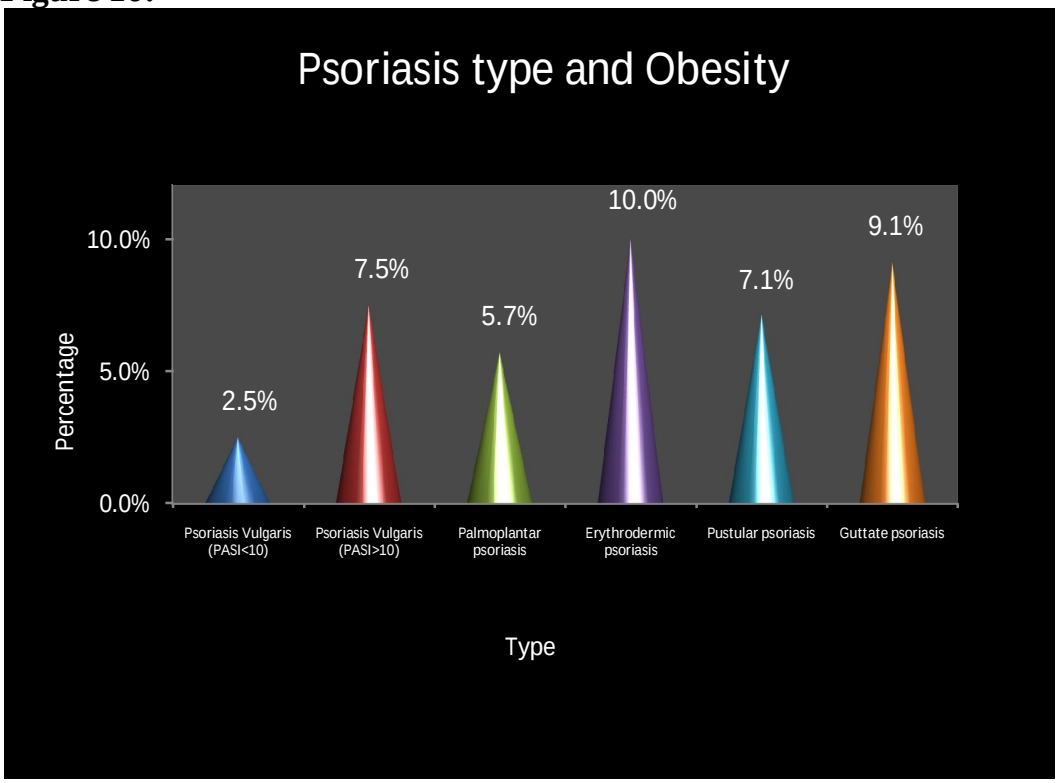

Duration of disease and Obesity
15.0%
10.0%
5.0%
0.0%
Percentage
Upto 5 yrs
Above 5 yrs
5.6%
10.7%
Duration

Figure 16:


Psoriasis type and Obesity
10.0%
5.0%
0.0%
Percentage
2.5%
7.5%
5.7%
10.0%
7.1%
9.1%
Psoriasis Vulgaris (PASI<10)
Psoriasis Vulgaris (PASI>10)
Palmoplantar psoriasis
Erythrodermic psoriasis
Pustular psoriasis
Guttate psoriasis
Type

DIABETES MELLITUS

This was present in 16(9.34%) out of 171 patients.

Their age distribution (Fig.17) varies from 29 to 70 years

Age in years	Number of patients		Percentage	p-value
	Total	Diabetes mellitus		
Upto 40	92	4	4.35%	0.0152
Above 40	79	12	15.19%	

Their sex distribution (Fig.18) was given in the table

Sex	Number of patients		Percentage	p-value
	Total	Diabetes mellitus		
Males	107	12	11.21%	0.2819
Females	64	4	6.25%	

Duration of psoriasis in diabetes varies from 2 months to 26 years and it is given in figure 19.

It is common in psoriasis vulgaris (PASI>10). It was also observed in other types as shown in the table below and figure 20.

Type	Number of patients		Percentage
	Total	Diabetes mellitus	
Psoriasis Vulgaris (PASI <10)	40	4	10%
Psoriasis Vulgaris (PASI >10)	40	6	15%
Palmoplantar psoriasis	35	1	2.85%
Erythrodermic psoriasis	20	3	15%
Pustular psoriasis	14	2	14.28%
Guttate psoriasis	22	0	0%

Severity of psoriasis in diabetic patients is given below

Severity	Number of patients		Percentage	p-value
	Total	Diabetes mellitus		
Mild or Moderate	94	5	5.31%	0.0451
Severe	77	11	14.28%	

Figure 17:

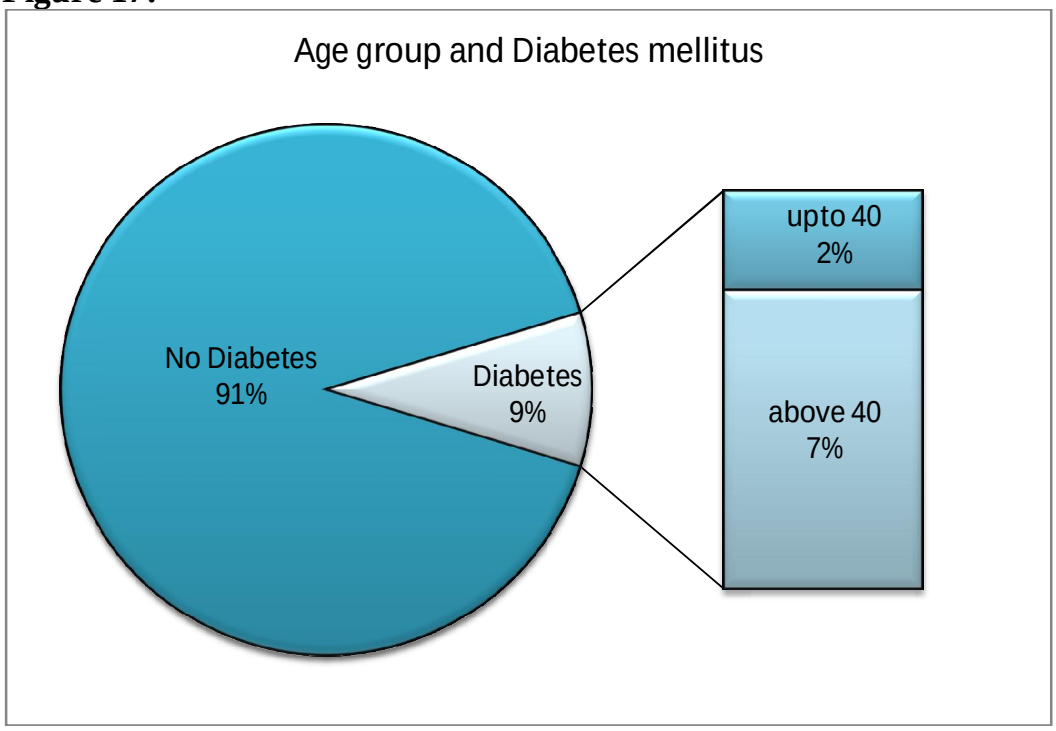


Figure 18:

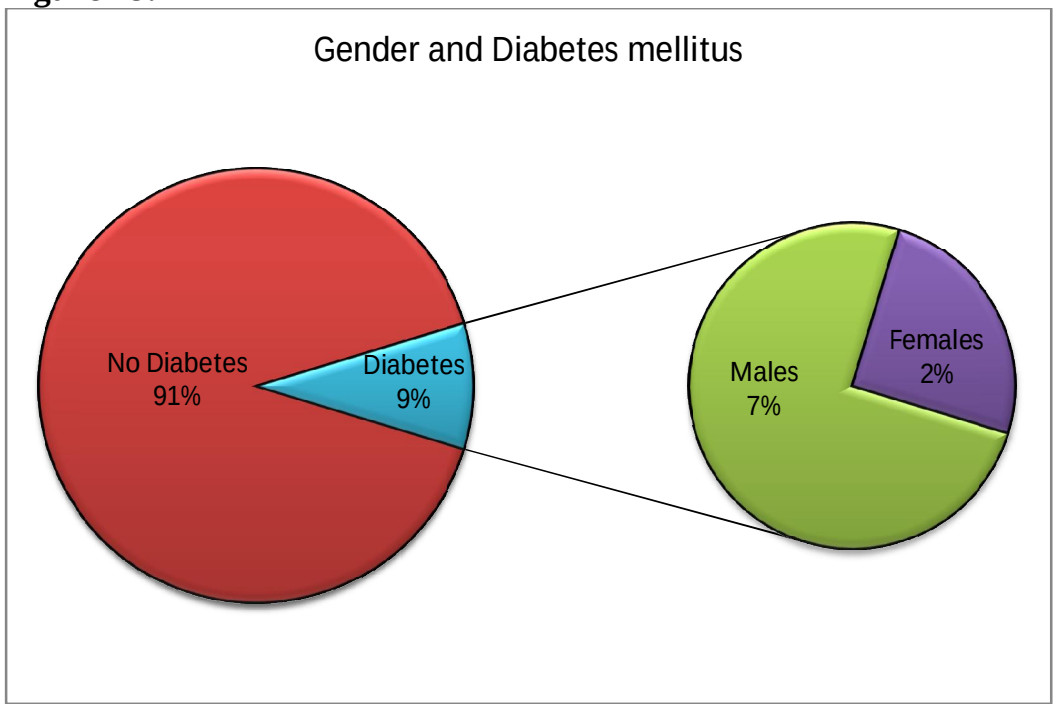


Figure 19:

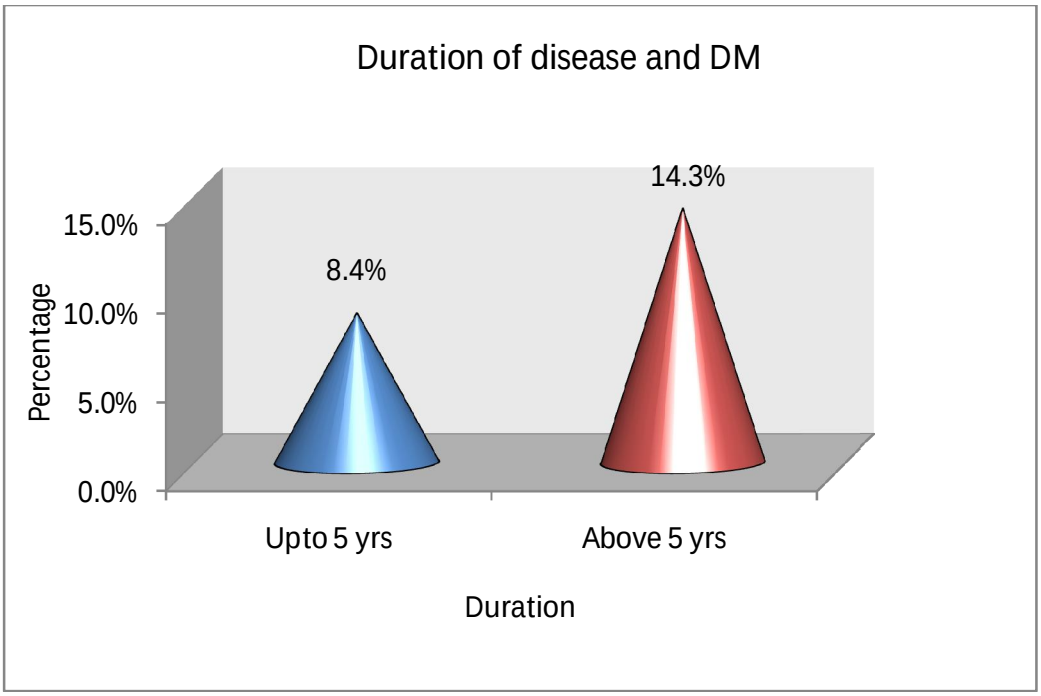
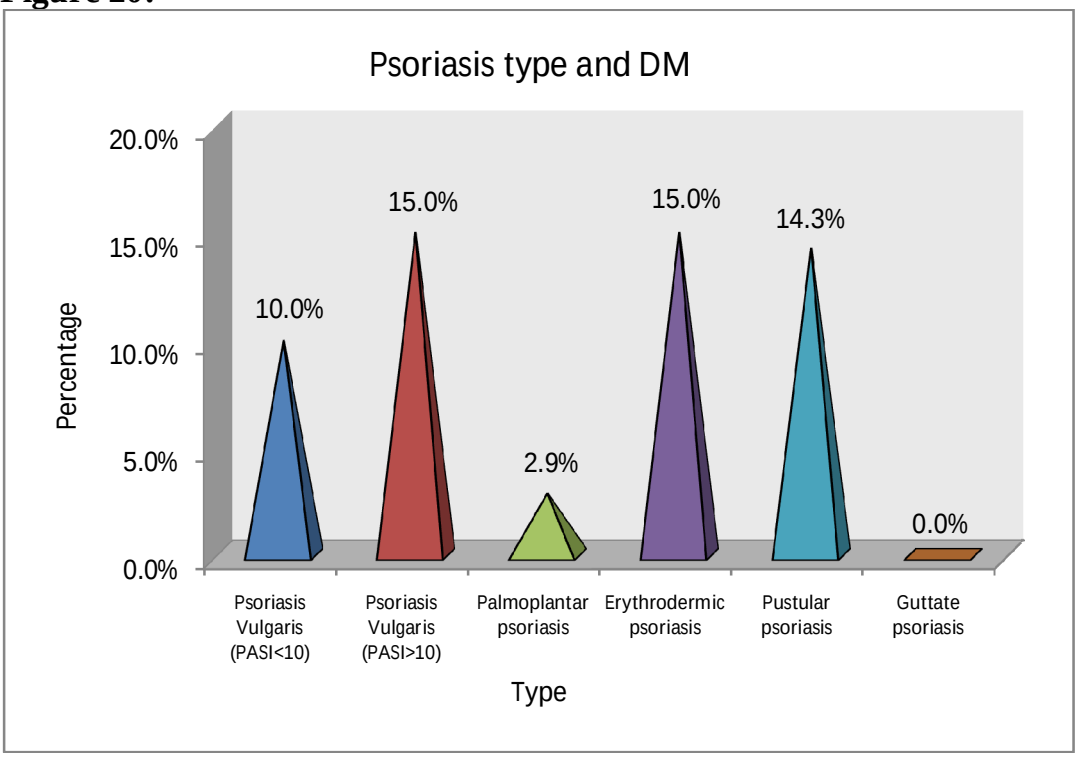

Duration of disease and DM
15.0%
10.0%
5.0%
0.0%
Percentage
8.4%
14.3%
Upto 5 yrs
Above 5 yrs
Duration

Figure 20:


Psoriasis type and DM
20.0%
15.0%
10.0%
5.0%
0.0%
Percentage
10.0%
15.0%
2.9%
15.0%
14.3%
0.0%
Psoriasis Vulgaris (PASI<10)
Psoriasis Vulgaris (PASI>10)
Palmoplantar psoriasis
Erythrodermic psoriasis
Pustular psoriasis
Guttate psoriasis
Type

DYSLIPIDEMIA

This was present in 112(65.5%) out of 171 patients.

Their age distribution (Fig.21) varies from 10 to 70 years and it was given in the table below

Age in years	Number of patients		Percentage
	Total	Dyslipidemia	
1-10	5	2	40%
11-20	22	12	54.5%
21-30	30	20	66.66%
31-40	35	23	65.71%
41-50	33	24	72.72%
51-60	32	22	68.75%
>60	14	9	64.28%

Sex distribution (Fig.22) of patients with dyslipidemia was given here.

Sex	Number of patients		Percentage	p-value
	Total	Dyslipidemia		
Males	107	67	62.61%	0.3075
Females	64	45	70.31%	

Duration of psoriasis varies from 10 days to 20 years in patients having Dyslipidemia and it is given in figure 23.

It is common in pustular psoriasis but noted in other types too as given below and figure 24.

Type	Number of patients		Percentage
	Total	Dyslipidemia	
Psoriasis Vulgaris (PASI <10)	40	25	62.5%
Psoriasis Vulgaris (PASI >10)	40	28	70%
Palmoplantar psoriasis	35	24	68.57%
Erythrodermic psoriasis	20	7	35%
Pustular psoriasis	14	11	78.57%
Guttate psoriasis	22	17	77.27%

Distribution of dyslipidemia with respect to severity of psoriasis is given here

Severity	Number of patients		Percentage	p-value
	Total	Comorbidities		
Mild or Moderate	94	63	67.02%	0.6432
Severe	77	49	63.63%	

Figure 21:

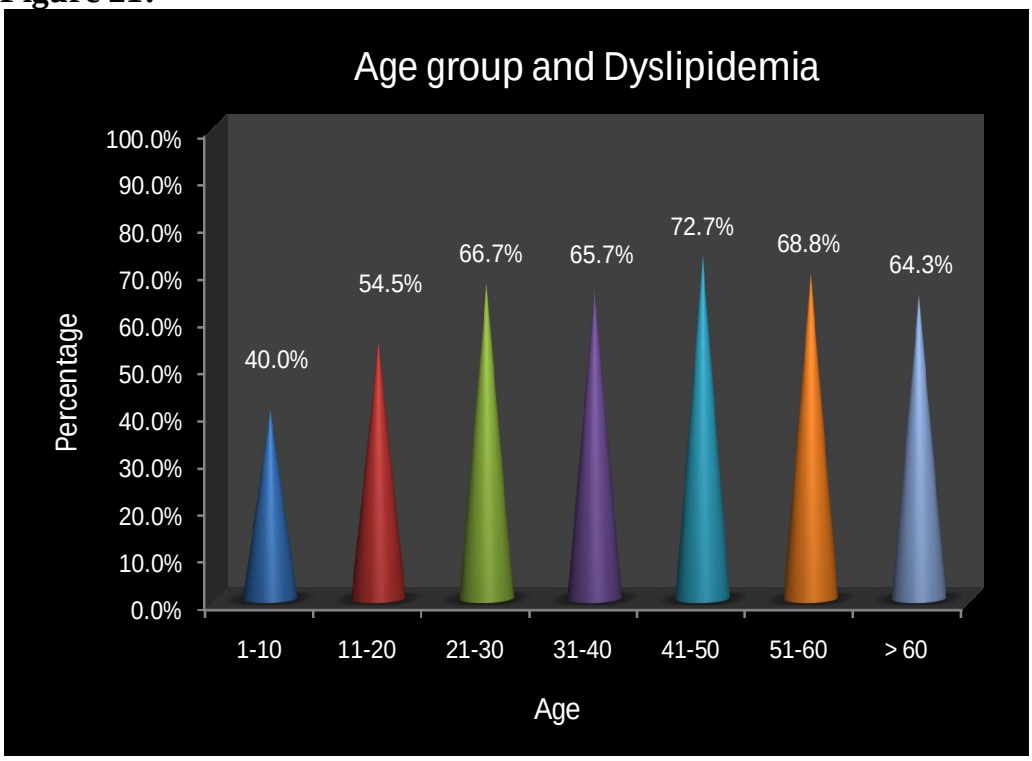


Figure 22:

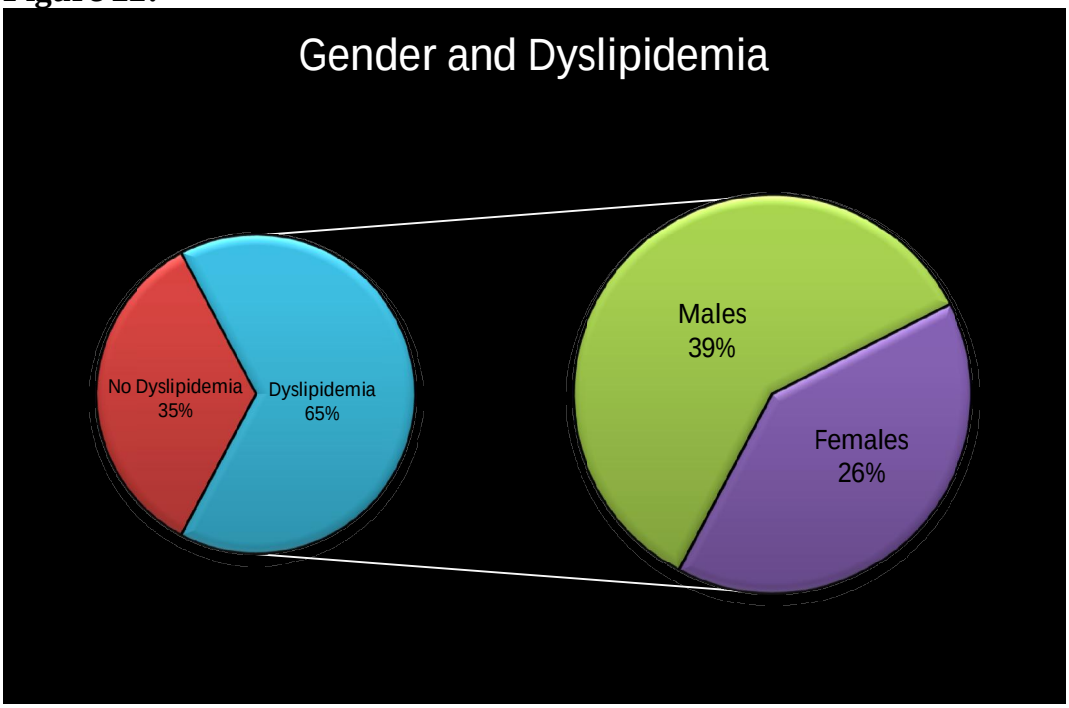


Figure 23:

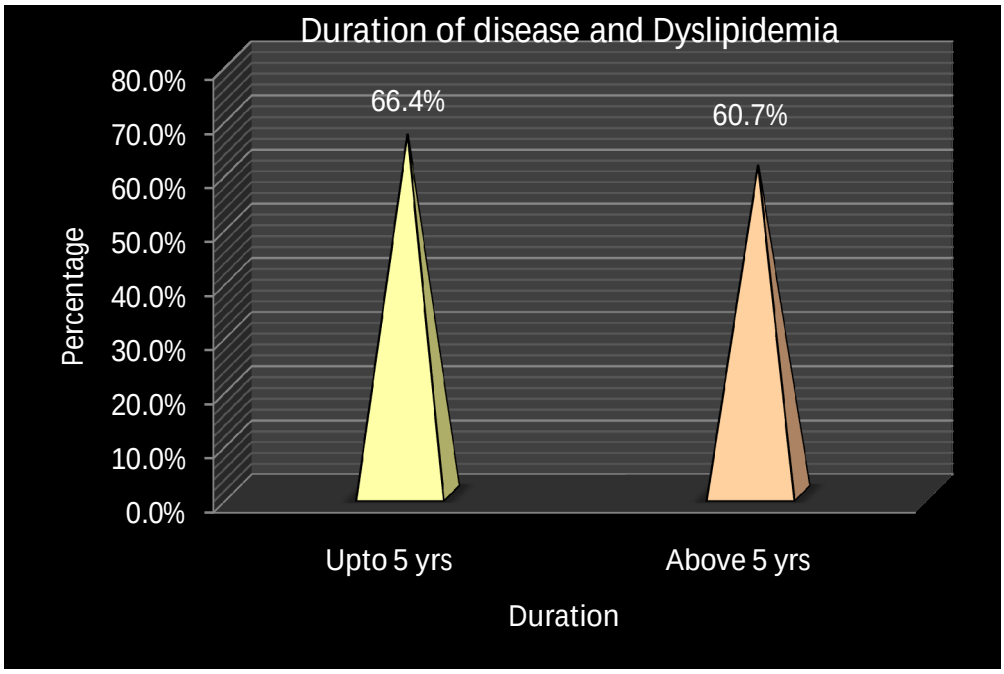
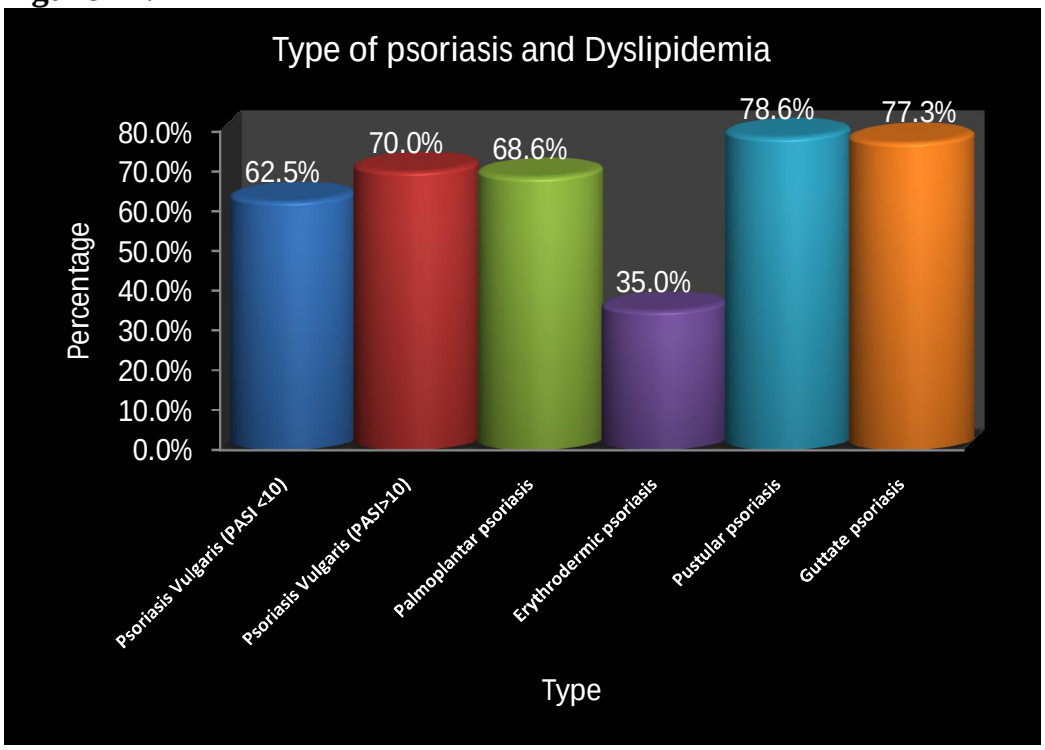

Duration of disease and Dyslipidemia
80.0%
70.0%
60.0%
50.0%
40.0%
30.0%
20.0%
10.0%
0.0%
Percentage
66.4%
60.7%
Upto 5 yrs
Above 5 yrs
Duration

Figure 24:


Type of psoriasis and Dyslipidemia
80.0%
70.0%
60.0%
50.0%
40.0%
30.0%
20.0%
10.0%
0.0%
Percentage
62.5%
70.0%
68.6%
35.0%
78.6%
77.3%
Psoriasis Vulgaris (PASI <10)
Psoriasis Vulgaris (PASI>10)
Palmoplantar psoriasis
Erythrodermic psoriasis
Pustular psoriasis
Guttate psoriasis
Type

METABOLIC SYNDROME

This was present in 15(8.77%) out of 171 patients.

Their age distribution (Fig. 25) varies from 33 to 70 years

Age in years	Number of patients		Percentage	p-value
	Total	Metabolic syndrome		
Upto 40	92	2	2.17%	0.001
Above 40	79	13	16.45%	

The sex distribution (Fig. 26) of these patients was shown in the table

Sex	Number of patients		Percentage	p-value
	Total	Metabolic syndrome		
Males	107	8	7.47%	0.4388
Females	64	7	10.94%	

Duration of psoriasis in them varies from 1 month to 10 years and it is shown in figure 27.

This is seen in erythrodermic psoriasis, palmoplantar psoriasis, psoriasis vulgaris (PASI >10), psoriasis vulgaris (PASI <10) and pustular types in increasing order of frequency. This is shown in figure 28 to 32.

Type	Number of patients		Percentage
	Total	Metabolic syndrome	
Psoriasis vulgaris (PASI <10)	40	5	12.5%
Psoriasis vulgaris (PASI >10)	40	4	10%
Palmoplantar psoriasis	35	3	8.57%
Erythrodermic psoriasis	20	1	5%
Pustular psoriasis	14	2	14.28%
Guttate psoriasis	22	0	0%

Patients with metabolic syndrome had severity of psoriasis as follows

Severity	Number of patients		Percentage	p-value
	Total	Comorbidities		
Mild or Moderate	94	8	8.51%	0.894
Severe	77	7	9.09%	

Figure 25:

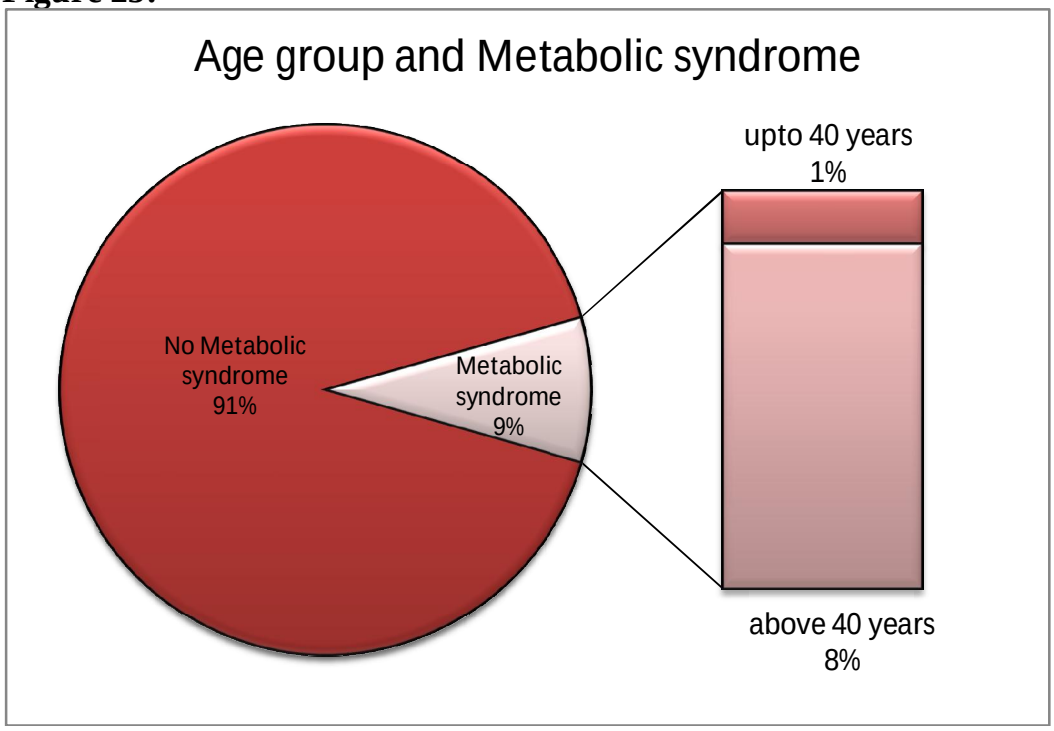


Figure 26:

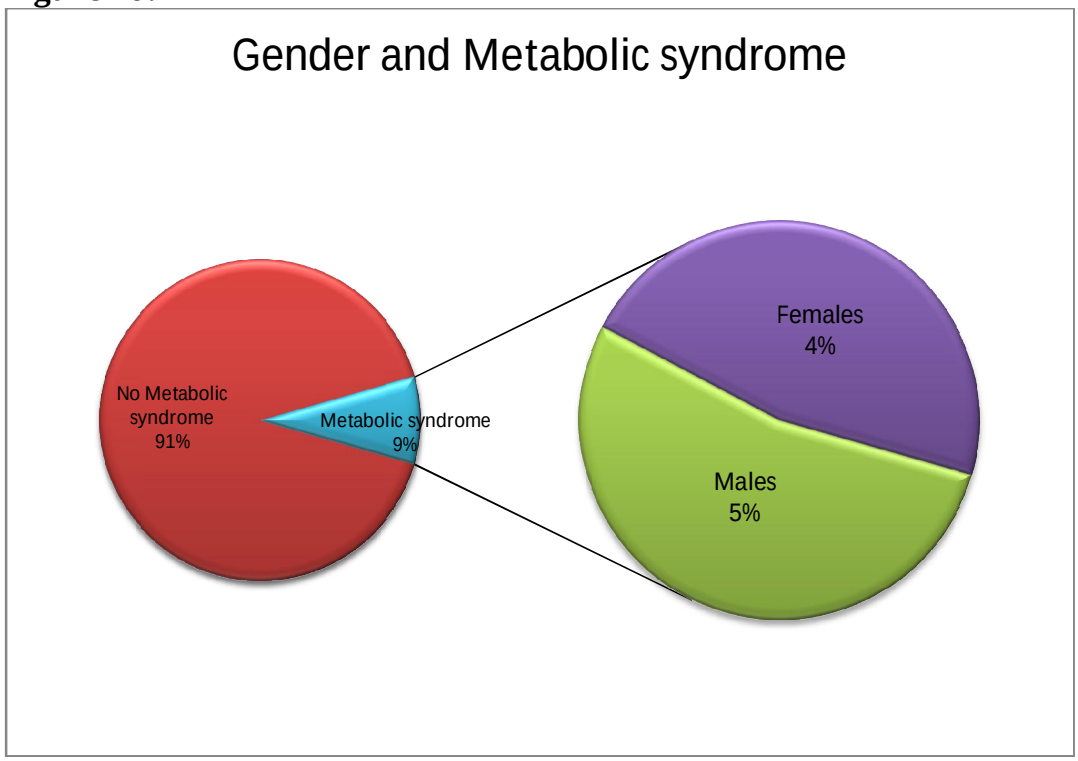


Figure 27:

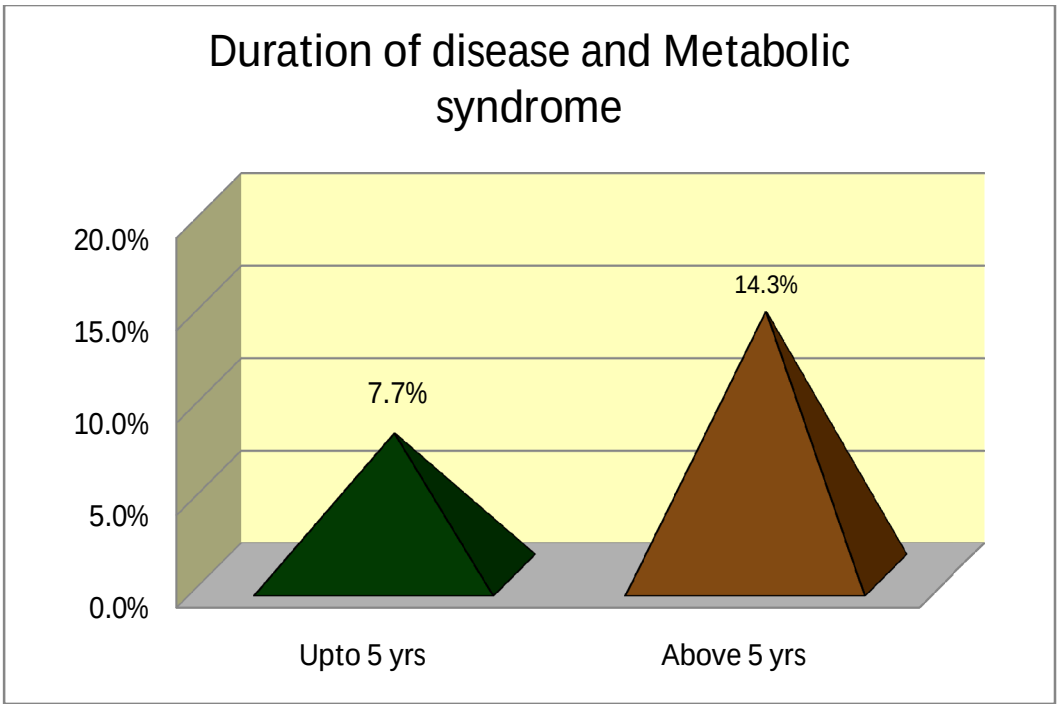

Duration of disease and Metabolic syndrome
20.0%
15.0%
10.0%
5.0%
0.0%
7.7%
14.3%
Upto 5 yrs
Above 5 yrs

Figure 28:

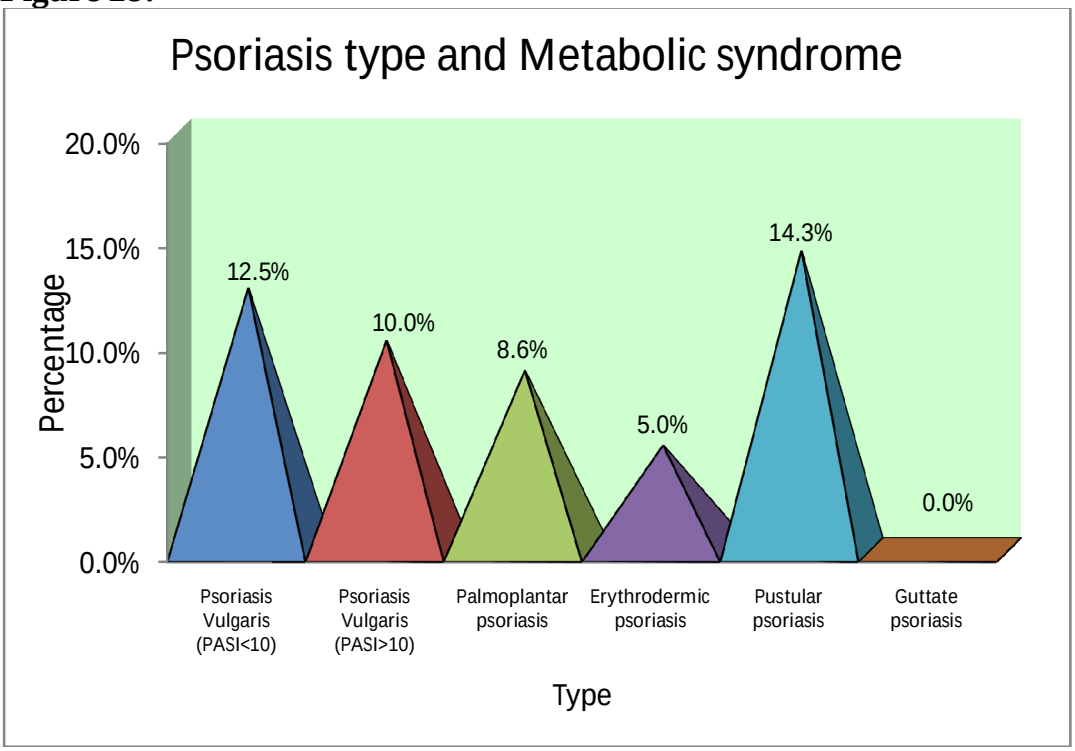

Psoriasis type and Metabolic syndrome
Percentage
20.0%
15.0%
10.0%
5.0%
0.0%
12.5%
10.0%
8.6%
5.0%
14.3%
0.0%
Psoriasis Vulgaris (PASI<10)
Psoriasis Vulgaris (PASI>10)
Palmoplantar psoriasis
Erythrodermic psoriasis
Pustular psoriasis
Guttate psoriasis
Type

Figure 29

Psoriasis vulgaris of mild type in a male with waist circumference of 116 cm

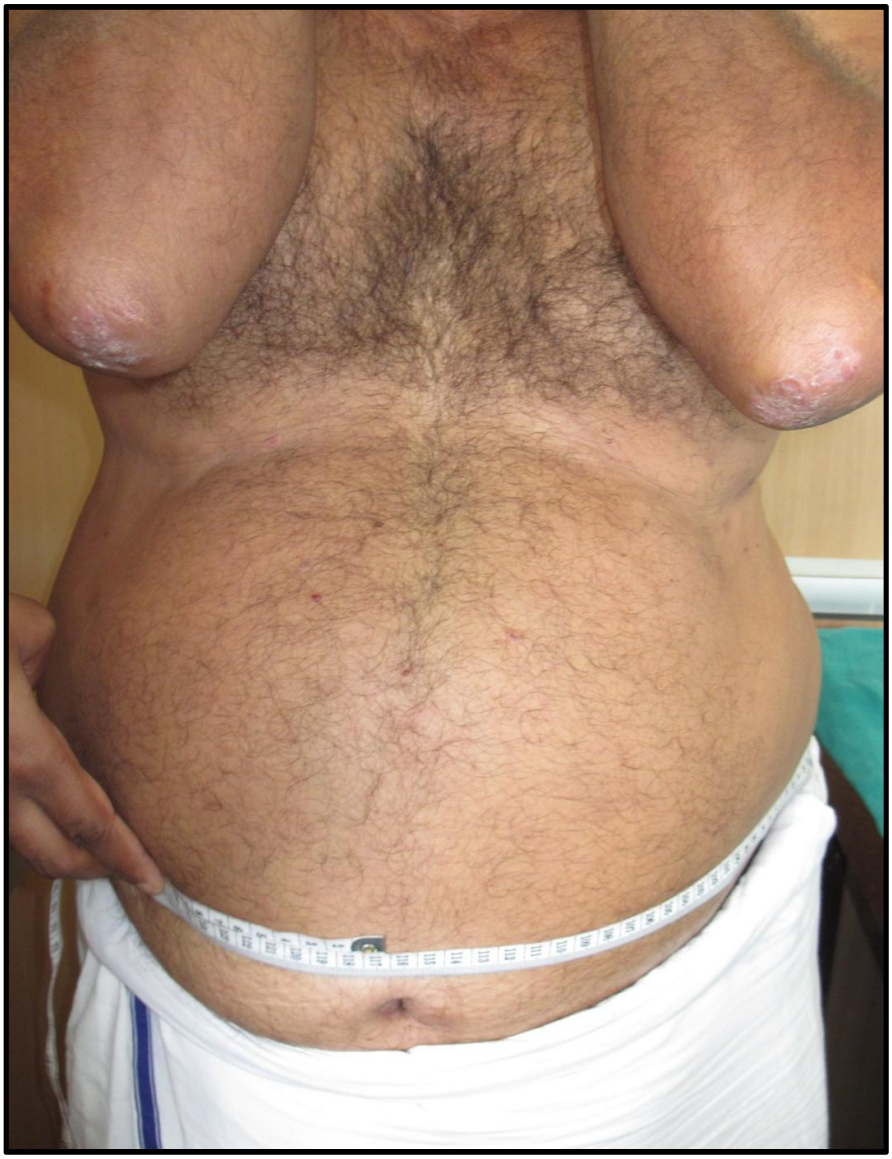


Figure 30

Psoriasis vulgaris of severe type in a male with waist circumference of 109 cm

Figure 31

Psoriasis vulgaris of severe type in a female with waist circumference of 94 cm

Figure 32

Psoriatic erythroderma in a male with waist circumference of 113 cm

MYOCARDIAL INFARCTION

This was present in 8(4.68%) out of 171 patients. They had anteroseptal myocardial infarction or inferior wall myocardial infarction or unstable angina. Their ECGs are shown in figure 33 to 35.

Their age distribution was from 44 to 67 years

Age in years	Number of patients		Percentage	p-value
	Total	Myocardial infarction		
Upto 40	92	Nil	0%	0.002
Above 40	79	8	10.13%	

Their sex distribution (Fig. 36) was given below in the table

Sex	Number of patients		Percentage	p-value
	Total	Myocardial infarction		
Males	107	7	6.54%	0.1357
Females	64	1	1.56%	

Duration of psoriasis in them varies from 1to 19 years and it is shown in figure 37.

It is seen in psoriasis vulgaris, pustular psoriasis and erythrodermic type in increasing order of frequency and this is given in figure 38.

Type	Number of patients		Percentage
	Total	Myocardial infarction	
Psoriasis Vulgaris (PASI <10)	40	2	5%
Psoriasis Vulgaris (PASI >10)	40	2	5%
Palmoplantar psoriasis	35	0	0%
Erythrodermic psoriasis	20	3	15%
Pustular psoriasis	14	1	7.14%
Guttate psoriasis	22	0	0%

Distribution of myocardial infarction with respect to severity of psoriasis is shown here.

Severity	Number of patients		Percentage	p-value
	Total	Myocardial infarction		
Mild - Moderate	94	2	2.12%	0.0810
Severe	77	6	7.79%	

Figure 33
ECG of psoriasis vulgaris patient with anteroseptal myocardial infarction

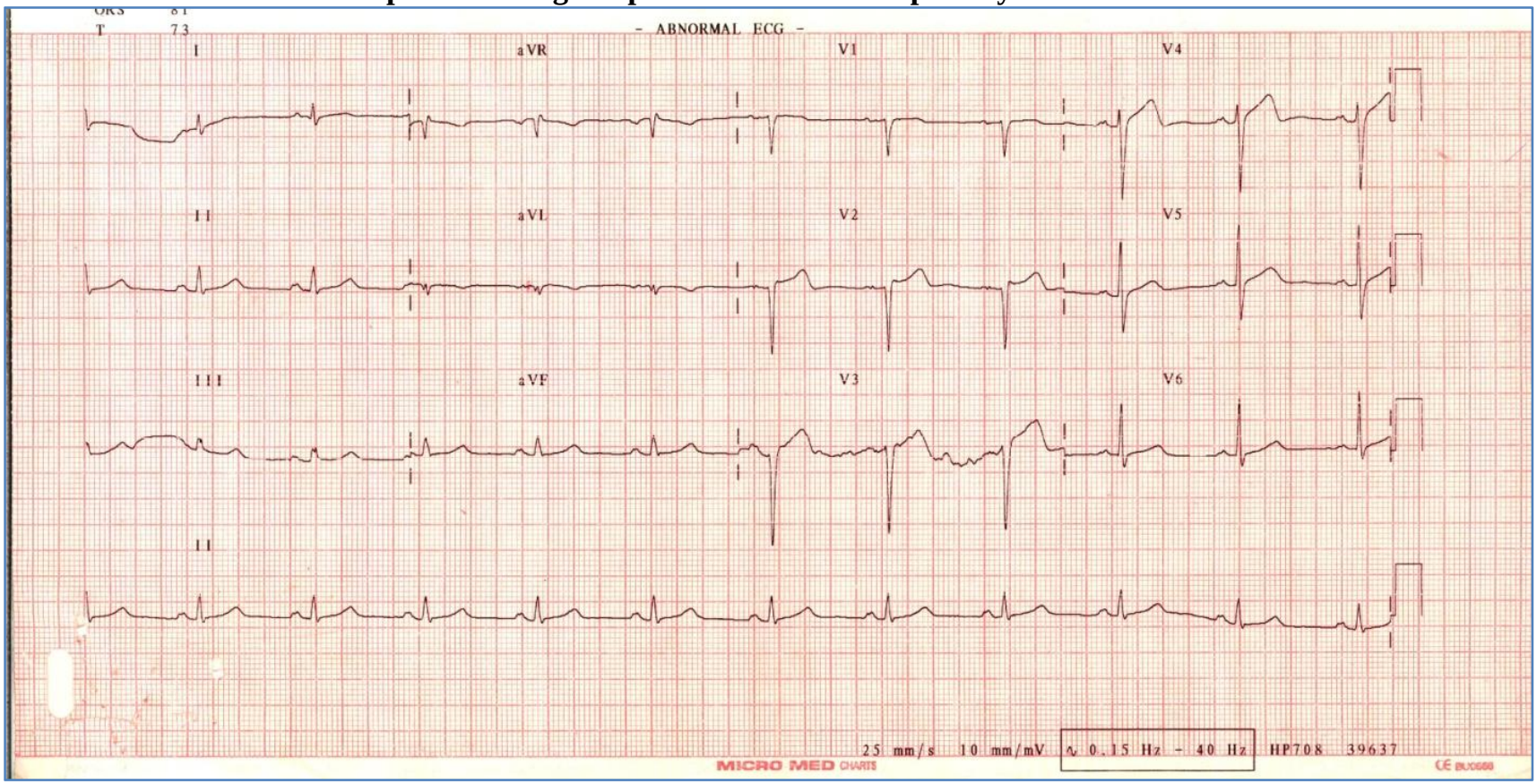


Figure 34
ECG of psoriatic erythroderma patient with inferior wall myocardial infarction

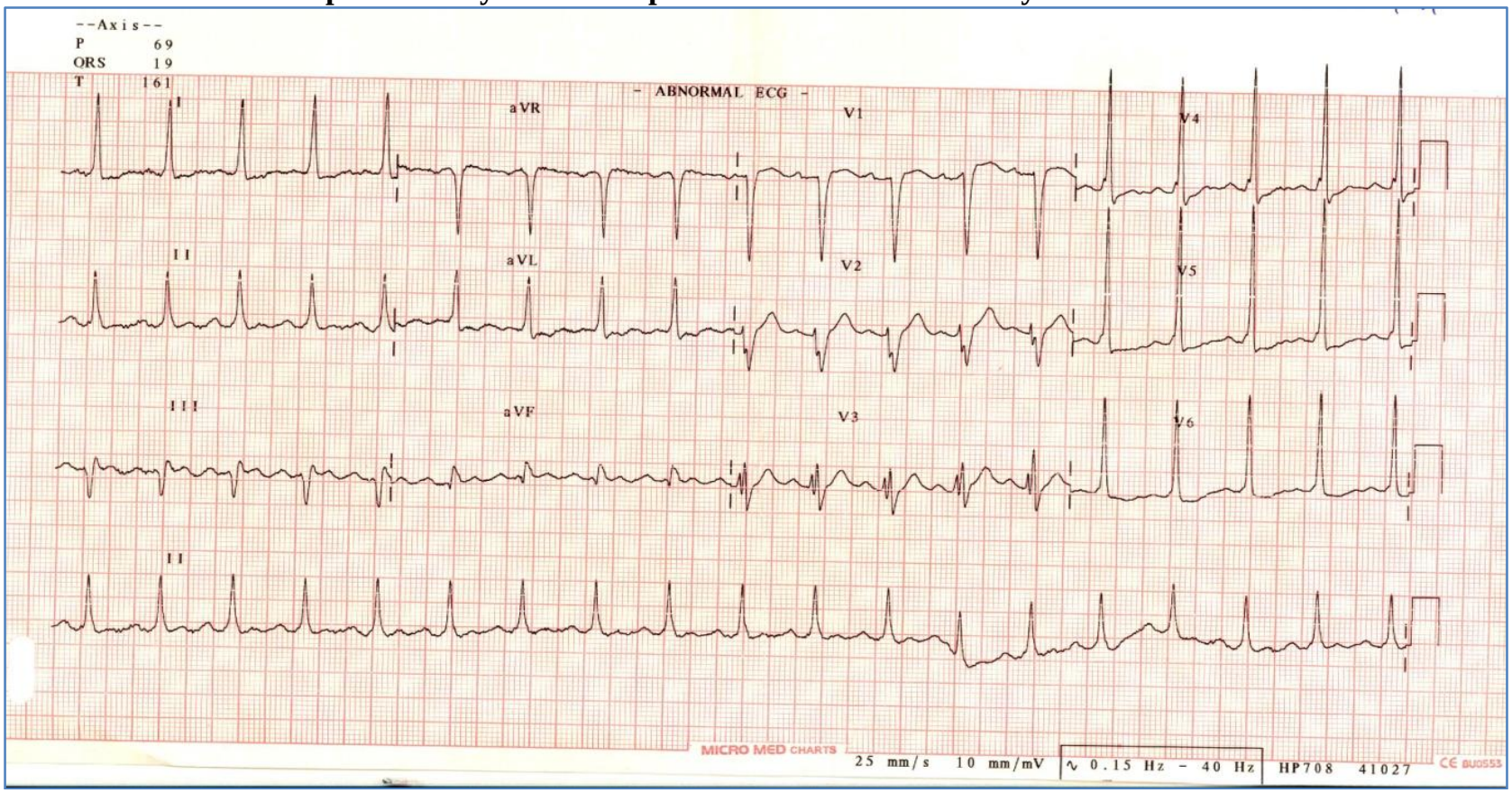


Figure 35
ECG of psoriasis vulgaris patient with unstable angina

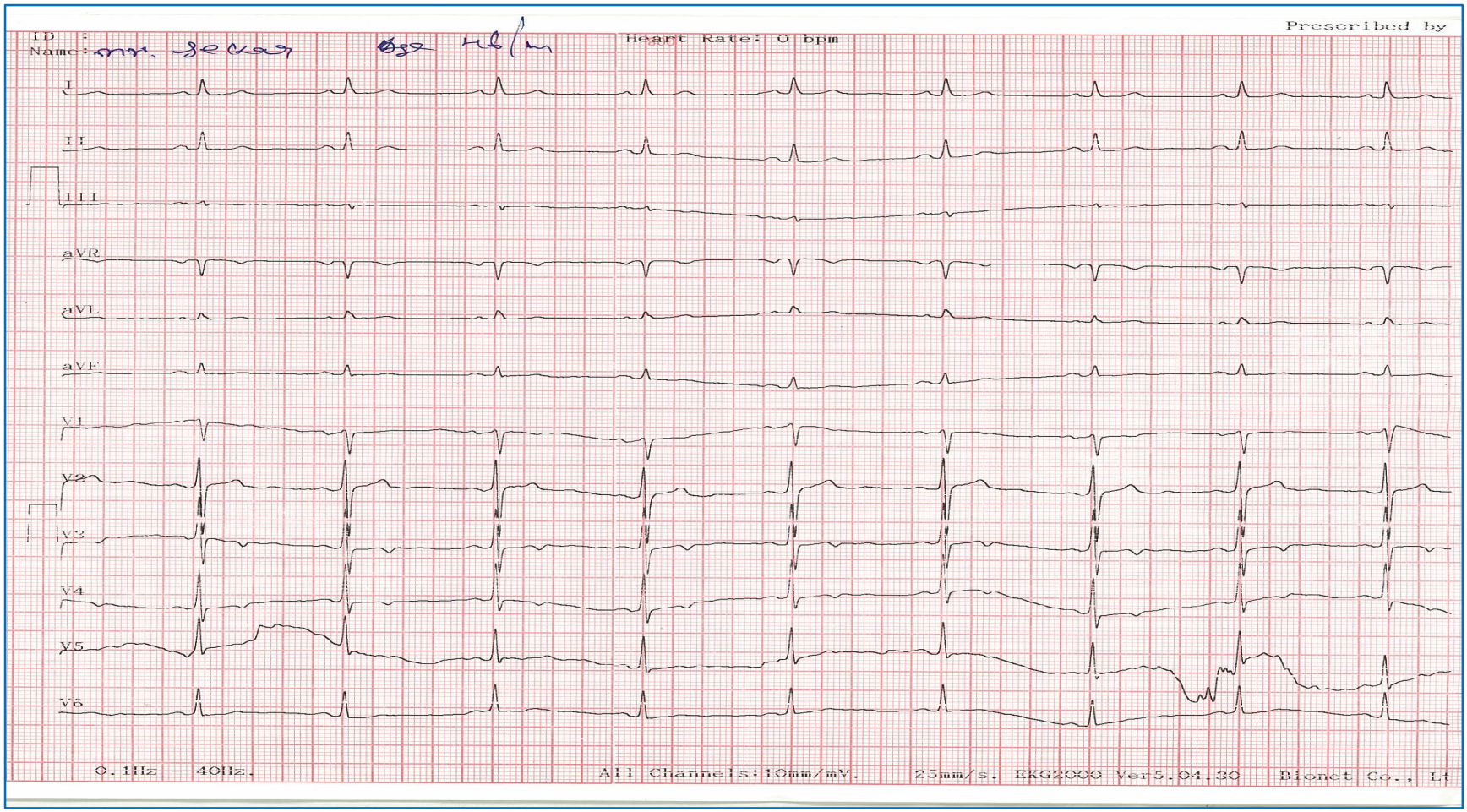


Figure 36:

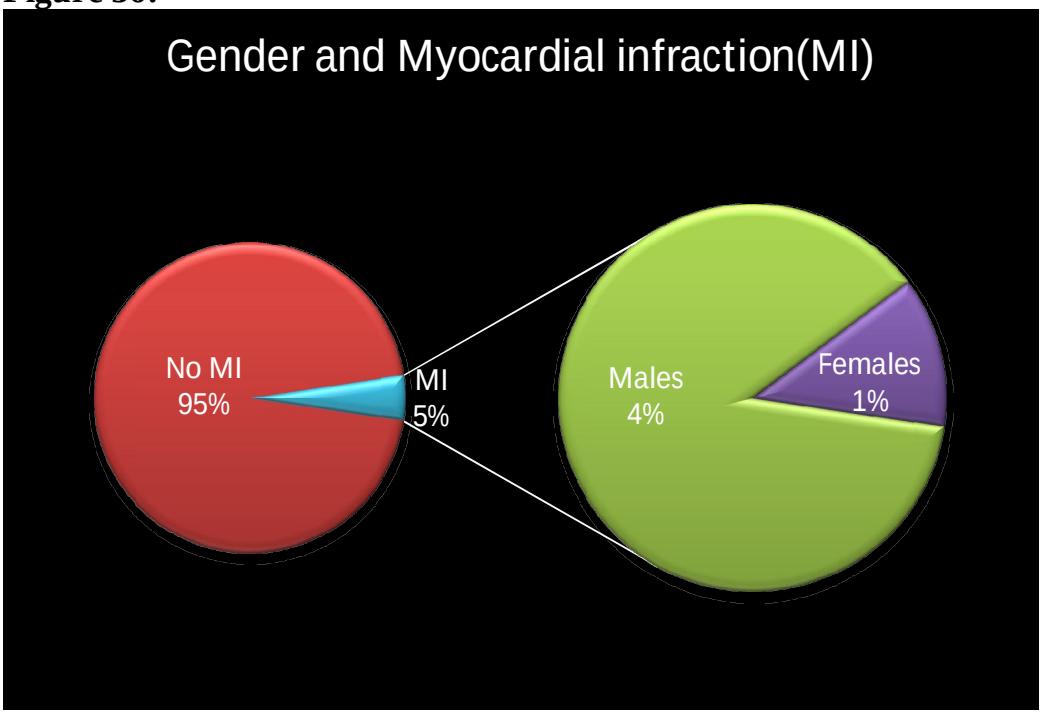


Figure 37:

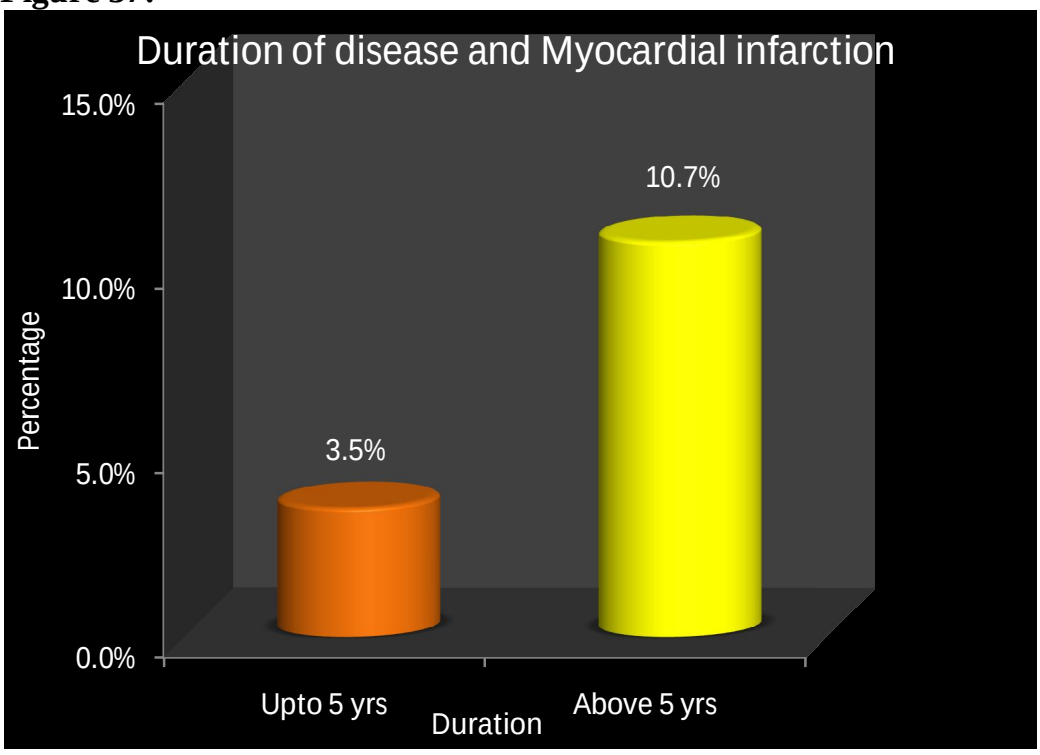
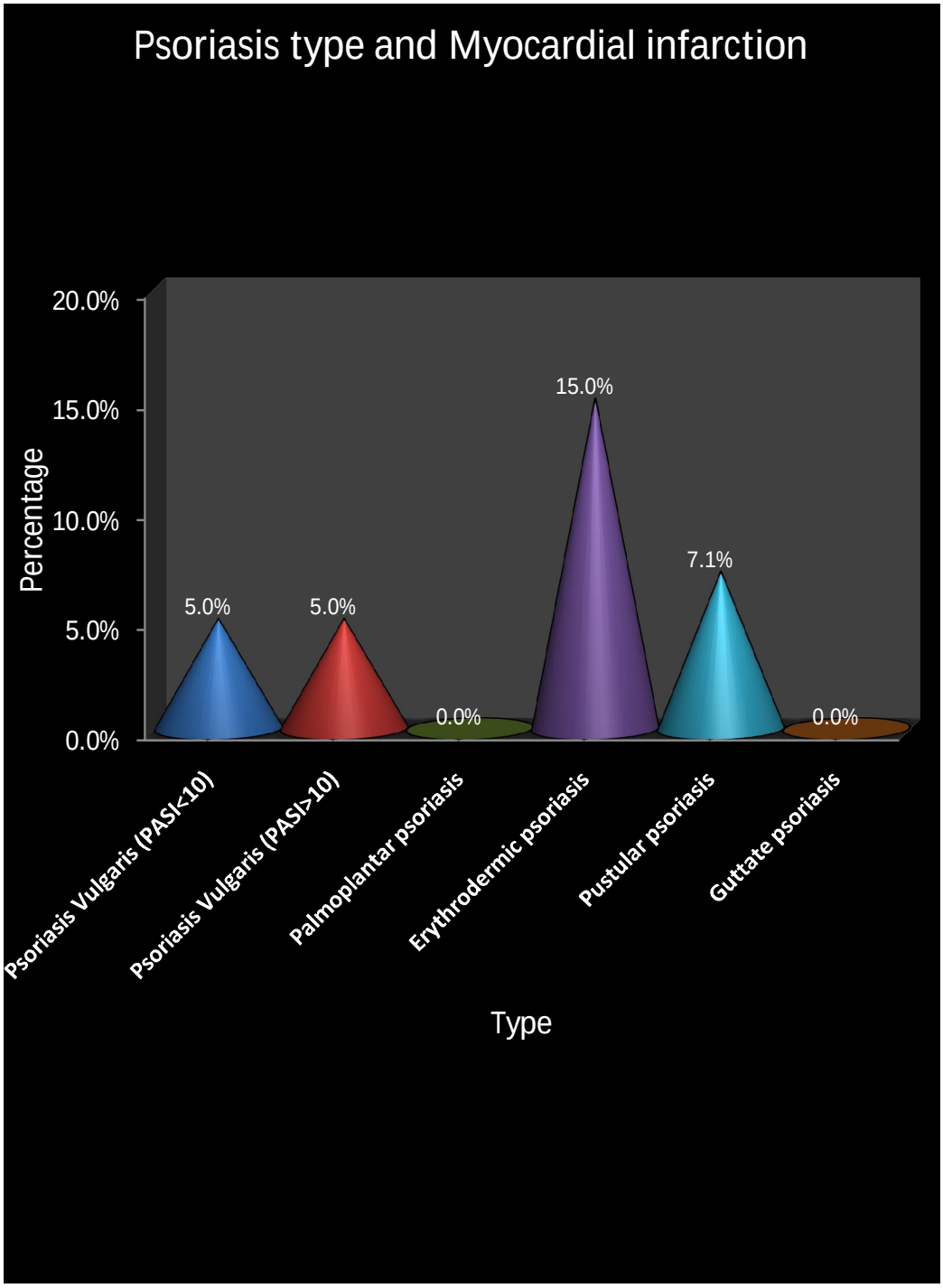


Figure 38:


Psoriasis type and Myocardial infarction
20.0%
15.0%
10.0%
5.0%
0.0%
Percentage
5.0%
5.0%
0.0%
15.0%
7.1%
0.0%
Psoriasis Vulgaris (PASI<10)
Psoriasis Vulgaris (PASI>10)
Palmoplantar psoriasis
Erythrodermic psoriasis
Pustular psoriasis
Guttate psoriasis
Type

FATTY LIVER DISEASE

This was seen in 44(25.73%) of our patients. Males(30 patients) outnumbered the females(14 patients) and half of the males were alcoholics.

DEPRESSION

One of our patient had depression which had simultaneous onset with psoriasis.

PERIPHERAL VASCULAR DISEASE (Figure 39)

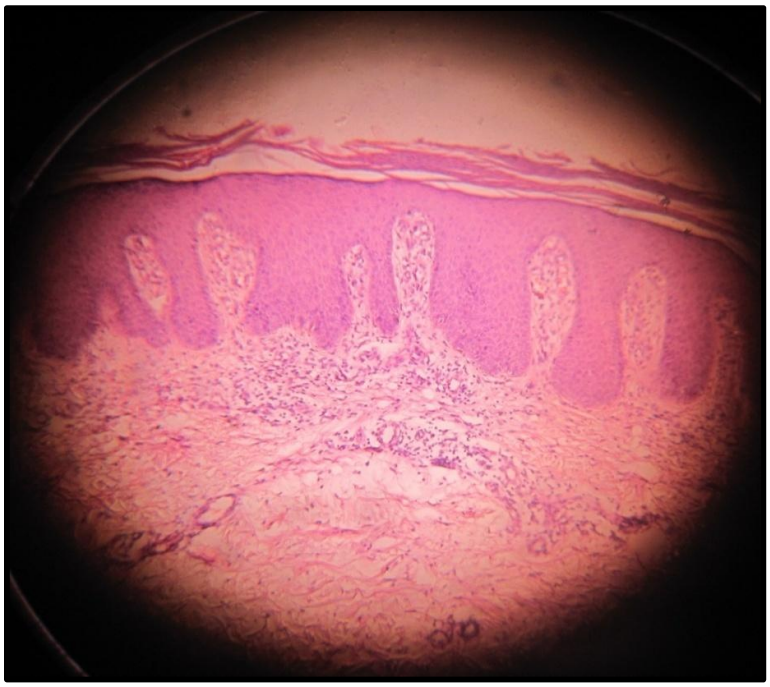
Two of our patients had peripheral vascular disease. It occurred before the onset of psoriasis in one patient (duration of peripheral vascular disease -15 years, duration of psoriasis – 13 years)

Figure 39

Psoriasis vulgaris patient having autoamputation of left 2nd toe following peripheral vascular disease

Figure 40

Histopathology of the patient with psoriasis vulgaris



DISCUSSION

In the present era, psoriasis is emerging as an important skin disease associated with various comorbidities. These comorbidities are associated with increased risk of morbidity and mortality. The chronic inflammatory nature of psoriasis is responsible for the occurance of comorbidities and TNF α plays a central role in this. Several studies have documented its occurrence in psoriasis. We designed this study to highlight the association of common clinical types of psoriasis and comorbidities.

Comorbidities:

Comorbidities were seen in 71.93%(123/171) of psoriasis patients in our study. Like previous studies, the major comorbidities observed in our study were Hypertension,[50,69] Obesity,[50,69] Diabetes mellitus,[19,26,50,63] Dyslipidemia,[50,74-79] Metabolic syndrome,[25,56,57] Myocardial infarction.[24,36-38] In addition to the above few of them had fatty liver disease, depression and peripheral vascular disease.

Most of the patients had one comorbidity (47.95%) followed by two in some and more than two comorbidities in few patients. Dyslipidemia (65.5%) was the commonest comorbidity in our study followed by Hypertension (15.2%), Diabetes mellitus (9.34%), Metabolic syndrome (8.77%), Obesity (6.43%), Myocardial infarction (4.68%).

A study conducted by Jayakar Thomas et.al., at Tamilnadu, stated that obesity was seen in 6.6% of psoriatics[21]. Another study by J.A. Kaye et.al, at U.K, also said 6.3% of psoriatics were obese.[50]

Age and comorbidities:

Most of the patients with comorbidites were in the age group of 31 to 70 years. To our surprise we noticed dyslipidemia in those aged between 10 to 20 years in our study. It was the only comorbidity observed in them. So we suggest that dyslipidemia can occur at any age from 10 years onwards. The study by M.Augustin et al., supports our concept.[3]

Statistically significant proportion of patients with hypertension, diabetes mellitus, metabolic syndrome, myocardial infarction were aged above 40 years. The respective p-values are <0.001, 0.0152, 0.001, 0.002. A study conducted previously by Gisondi et.al., supports our concept of occurance of metabolic syndrome in those aged above 40 years[57].

Dyslipidemia and obesity were seen at younger age in our study and this is supported by the study by M.Augustin et al., at Germany[3]. Since dyslipidemia and obesity are the risk factors for myocardial infarction, young psoriasis patients are more likely to have myocardial infarction as stated in the previous studies. [35,39,40,41]

Gender and comorbidities:

Both males and females had comorbidities and there was no statistically significant difference in occurance of comorbidities between them (p-value: 0.2987). All comorbidities observed in this study were seen in both the sexes. A study carried out by Gisondi et.al., also stated the metabolic syndrome can affect both sexes[57], and this supports our results.

Duration of psoriasis and comorbidities:

Duration of psoriasis in patient with comorbidities varies widely in our study.There was no significant difference in the occurance of comorbidities in those having the disease for upto 5 years and above 5 years (p-value: 0.1887). Although few studies have mentioned that comorbidities were frequent with increase in duration of psoriasis[26] this was not noted in our study.

History of comorbidities:

Only 9.94% of our patients were aware that they had comorbidities while presenting to us and few of them were already on treatment with drugs which may aggravate psoriasis. This stresses the importance of awareness of side effects and interaction of drugs. Few of our patients gave history of comorbidies in their family members irrespective of their current comorbidity.

Type of psoriasis and comorbidities:

Comorbidities were commonly seen in psoriasis vulgaris of severe type (85%) in our study followed by pustular psoriasis (78.5%), guttate psoriasis (77.27%), palmoplantar psoriasis (74.29%), psoriasis vulgaris of mild to moderate type (65%) and erythrodermic type(45%).

All the 6 comorbidities mentioned above were seen in psoriasis vulgaris, erythrodermic and pustular type, while dylipidemia and obesity were the only observed comorbidity in guttate psoriasis and myocardial infarction was not observed in palmoplantar psoriasis in our study.

In our study hypertension was common in palmoplantar type. Obesity, diabetes mellitus, myocardial infarction were common in psoriatic erythroderma. Dyslipidemia and metabolic syndrome were observed commonly in pustular psoriasis. The prevalence of comorbidities in common types is shown below:

S.No.	Comorbidities	Type of psoriasis
1.	Hypertension	Palmo plantar psoriasis - 22.86% Psoriasis vulgaris(PASI >10) – 20%
2.	Obesity	Psoriatic erythroderma – 10% Guttate psoriasis – 9.09%
3.	Diabetes mellitus	Psoriatic erythroderma – 15% Psoriasis vulgaris(PASI >10) – 15% Pustular psoriasis – 14.28%
4.	Dyslipidemia	Pustular psoriasis – 78.57% Guttate psoriasis – 77.27%
5.	Metabolic syndrome	Pustular psoriasis – 14.28% Psoriasis vulgaris(PASI <10) – 12.5%
6.	Myocardial infarction	Psoriatic erythroderma – 15% Pustular psoriasis – 7.14%

This reveals that any comorbidities can occur in any type of psoriasis. Hence detection and treatment of comorbidies is needed in all types of psoriasis.

Severity of psoriasis and comorbidities:

Few of the previous literature reports stated that comorbidities are common in severe disease.[13,45,63] But in our study, though comorbidities were commonly present in severe disease, it was also seen in mild type of psoriasis vulgaris and palmoplantar types.

Although slightly more number of patients with comorbidities had severe disease (Mild or moderate – 70.21% Vs Severe – 74.02%) it is not statistically significant (p-value: 0.5809). This states that comorbities can occur in psoriasis irrespective of its severity.

Diabetes mellitus was the only comorbidity in which statistically significant number of patients had severe disease (p-value: 0.0451). The study by Neimann AL, Shin DB, Wang X, et al., at U.K., supports this concept.[63]

Except diabetes mellitus all other comorbidities were present irrespective of severity of psoriasis. Previously Gisondi *et al.*, and Takahashi *et al.*, said that there was no correlation between severity of psoriasis and metabolic syndrome.[56] This study supports our results.

CONCLUSION

- Comorbidities in psoriasis is common and its prevalence is 71.93% in our study.
- The comorbidities observed in our study in the decreasing order of frequency are dyslipidemia, hypertension, diabetes mellitus, metabolic syndrome, obesity, myocardial infarction.
- Hypertension, diabetes mellitus, metabolic syndrome, myocardial infarction are common in those aged above 40 years while dyslipidemia and obesity are present in younger age.
- Both sexes had all the comorbidities and there is no statistically significant difference in its occurrence with respect to psoriasis duration or severity.
- Comorbidities are common in psoriasis vulgaris of severe type. They are also seen in psoriasis vulgaris of mild or moderate type, psoriatic erythroderma, guttate type, pustular and palmoplantar psoriasis.
- Our study states that psoriasis is emerging as a systemic disease in current days and it is not just skin deep.

- As Dermatologists we should be aware of these comorbidities since we have the unique opportunity to screen, identify and followup the comorbidities in psoriasis.

- So we strongly recommends screening for comorbidities in all patients with psoriasis, irrespective of their age, sex, duration of disease, severity and type of psoriasis.

- Even if comorbidities are not detected at screening, adapting healthy life style practices are highly needed from the time of diagnosis in present era to prevent these comorbidities.

- We would like to conclude that treatment of psoriasis successfully with a improvement in quality of life patients could be achived with unified management by dermatologists and other specialists.

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PROFORMA

S. No.: OP. No.: Psoriasis Clinic No.:

Name: Age: Sex:

Occupation:

Address : Rural / Urban Phone no.:

PRESENTING COMPLAINTS

HISTORY OF PRESENT ILLNESS

Evolution of disease:

H/O Itching:

H/O Sore throat:

H/O Drug intake:

H/O Seasonal variation:

H/O Remission and exacerbation:

H/O Trauma and surgeries:

H/O Joint Pain and swelling:

H/O Photosensitivity:

H/S/O diabetes or hypertension:

H/S/O cardiac diseases:

H/S/O respiratory diseases:

H/S/O gastrointestinal diseases:

H/S/O renal diseases:

H/S/O cerebrovascular disease:

H/O loss of weight and loss of appetite:

PAST HISTORY

H/O Similar illness:

Myocardial infarction / Psychiatric illness

Other illness:

FAMILY HISTORY

Psoriasis:

Comorbidities:

PERSONAL HISTORY

Alcoholism: Smoking:

MENSTRUAL AND OBSTETRIC HISTORY IN FEMALES

TREATMENT HISTORY

Psoriasis:

Comorbidities:

GENERAL EXAMINATION

Built: Nourishment:

Anaemia / Jaundice / Clubbing / Dyspnoea / Pedal edema/

Lymphadenopathy / JVP

BP: PR: Temperature:

Waist Circumferance: Weight: Height: BMI:

SYSTEMIC EXAMINATION

CVS: Abdomen:

RS: CNS:

Endocrine system:

DERMATOLOGICAL EXAMINATION

Description and extent of lesions:

Mucosa:

Hair:

Nails:

Joints (minor and major):

Type of psoriasis : PASI score:

Severity: Mild - moderate / severe

Any other associated cutaneous diseases:

INVESTIGATIONS

1. Skin biopsy:

2. Complete blood count: Hb% - DC: P - L - E -

TC - Platelets - ESR -

3. Fasting plasma glucose: 4.Postprandial plasma glucose:

5. Lipid profile: Total Cholesterol: Triglycerides: HDL:

LDL: VLDL:

6. ECG:

7. ECHO:

8.Chest X-Ray:

9.Urine:Albumin: Sugar: Deposits:

10.USG Abdomen:

11. LFT : Total Bilirubin: Total Proteins: Albumin: Globulin:

SGOT: SGPT: SAP:

12.HbsAg: 13. anti-HCV:

14.Blood urea: 15. Serum creatinine:

16.Serum electrolytes: 17. HIV-ELISA:

18.VDRL: 19. Serum Calcium:

20.Serum uric acid: 21. X-ray joints:

22. PT: 23. aPTT: 24. INR :

25.Doppler: 26.T3: 27.T4:

28.TSH: 29. Diabetology opinion:

30. HT clinic opinion:

31.Cardiologist opinion:

32.Chest physician opinion:

33.Gastroenterology opinion:

34. Orthopaedics Opinion:

35.Vascular Surgeon opinion:

36. Neurologist opinion:

37. Psychiatry opinion:

38. Endocrinology opinion:

39. STD opinion:

40.Others:

ENT opinion

Dental opinion:

Ophthalmology opinion:

Master charts

PSORIASIS VULGARIS(PASI < 10)

S.No	AGE	SEX	DD	CD	PASI	WC	BMI	FPG	CHO	LDL	TGL	HDL	USG	ECG	HT	OB	DM	↑CHO	↑LDL	↑TGL	↓HDL	MS	MI	OTHERS
1	58	M	8 Y	-	3	107	28	79	173	110	129	37	FL	N	-	-	-	-	+	-	+	-	-	PRE OBESE ,↑WC
2	37	M	3Y	-	4.2	74	21.1	85	142	64	131	52	N	N	-	-	-	-	-	-	-	-	-	-
3	55	M	3.5Y	HT-3Y	5.1	90	26.6	70	206	151	83	38	N	LVH	+	-	-	+	+	-	+	-	-	PRE OBESE
4	22	F	1 Y	-	2	57	14.6	97	160	95	116	42	N	N	-	-	-	-	-	-	-	-	-	-
5	48	M	1Y	-	1	68	17.5	76	149	89	89	42	N	N	-	-	-	-	-	-	-	-	-	-
6	24	M	4Y	-	6.8	94	25.2	85	200	134	123	41	FL	N	-	-	-	-	+	-	-	-	-	PRE OBESE
7	28	M	5Y	-	1.2	92	30.5	73	146	90	109	34	N	N	-	+	-	-	-	-	+	-	-	-
8	50	M	2Y	-	5.4	82	21.7	101	142	75	145	38	FL	N	-	-	-	-	-	-	+	-	-	-
9	71	M	6m	-	2	85	21.9	73	161	96	110	43	N	N	-	-	-	-	-	-	-	-	-	-
10	60	F	10Y	-	1.8	86	29.7	72	242	164	219	34	FL	N	-	-	-	+	+	+	+	-	-	PRE OBESE
11	54	F	3Y	-	2	78	21.3	68	131	64	81	51	N	N	-	-	-	-	-	-	-	-	-	-
12	57	M	1Y	-	6.4	95	25.5	98	187	90	289	39	FL	N	+	-	-	-	-	+	+	-	-	PRE OBESE
13	59	M	5Y	-	1.2	87	23.5	110	143	89	110	32	FL	UA	-	-	-	-	-	-	+	-	+	-
14	64	F	5Y	-	6.9	81	21	122	205	141	84	47	N	N	-	-	-	+	+	-	-	-	-	-
15	30	M	1Y	-	3.1	90	22.6	100	156	88	122	44	FL	N	-	-	-	-	-	-	-	-	-	-
16	46	M	4Y	-	5	88	22	100	148	77	144	42	FL	UA	-	-	-	-	-	-	-	-	+	-
17	52	F	1Y	-	2.8	85	28.5	67	209	137	161	40	FL	N	-	-	-	+	+	+	-	-	-	PRE OBESE
18	43	M	10Y	DM,HT-2Y	2.4	116	23.3	104	162	88	172	40	FL	N	+	-	+	-	-	+	-	+	-	↑ WC
19	42	M	4Y	-	1.5	85	25.5	95	165	109	80	40	N	N	-	-	-	-	+	-	-	-	-	PRE OBESE
20	70	M	4Y	-	1.6	75	24.5	206	291	240	98	31	N	N	+	-	+	+	+	-	+	+	-	-

PSORIASIS VULGARIS(PASI < 10)																								
S.No	AGE	SEX	DD	CD	PASI	WC	BMI	FPG	CHO	LDL	TGL	HDL	USG	ECG	HT	OB	DM	↑CHO	↑LDL	↑TGL	↓HDL	MS	MI	OTHERS
21	60	F	5m	-	4.8	96	29.3	81	181	106	111	43	N	N	+	-	-	-	+	-	+	+	-	PRE OBESE, ↑WC
22	60	F	3Y	-	2.6	83	28.5	186	200	116	237	37	RC	N	-	-	+	-	+	+	+	+	-	PRE OBESE
23	24	F	5Y	-	9.6	76	21.2	68	180	122	99	38	N	N	-	-	-	-	+	-	+	-	-	-
24	36	M	3Y	-	5.8	68	16.8	83	153	100	76	38	N	N	-	-	-	-	-	-	+	-	-	-
25	64	F	2m	-	0.4	87	21.1	279	128	76	91	34	N	N	+	-	+	-	-	-	+	+	-	-
26	54	M	3m	-	2.4	99	23.3	88	310	246	108	42	N	N	+	-	-	+	+	-	-	-	-	-
27	45	M	9m	-	4.2	86	23	87	135	54	174	46	N	N	-	-	-	-	-	+	-	-	-	-
28	58	M	2Y	-	6.6	88	25.6	94	196	113	180	47	N	N	-	-	-	-	+	+	-	-	-	PRE OBESE
29	13	F	1Y	-	8.4	57	13.5	60	140	64	131	50	N	N	-	-	-	-	-	-	-	-	-	-
30	12	F	4Y	-	4.2	58	16.3	86	182	111	92	53	N	N	-	-	-	-	+	-	-	-	-	-
31	13	M	6Y	-	7.6	65	17.4	95	145	91	109	32	N	N	-	-	-	-	-	-	+	-	-	-
32	13	M	2Y	-	1.1	57	18.1	83	150	105	75	30	N	N	-	-	-	-	+	-	+	-	-	-
33	10	M	2m	-	5.9	56	15	66	146	86	112	38	N	N	-	-	-	-	-	-	+	-	-	-
34	11	F	5Y	-	3.3	58	15.4	80	165	99	90	48	N	N	-	-	-	-	-	-	-	-	-	-
35	6	F	4Y	-	1.8	46	13.5	84	144	73	99	51	N	N	-	-	-	-	-	-	-	-	-	-
36	15	M	4Y	-	2.7	74	20	84	145	76	85	52	N	N	-	-	-	-	-	-	-	-	-	-
37	21	M	2Y	-	6.8	76	21.9	96	158	89	131	43	N	N	-	-	-	-	-	-	-	-	-	-
38	32	F	1Y	-	5.4	82	21.7	93	161	85	124	51	N	N	-	-	-	-	-	-	-	-	-	-
39	28	M	2Y	-	2.7	78	24.2	94	171	98	128	47	N	N	-	-	-	-	-	-	-	-	-	-
40	41	F	1Y	-	3.3	81	23.3	91	164	89	115	52	N	N	-	-	-	-	-	-	-	-	-	-

PSORIASIS VULGARIS (PASI > 10)

S.No	Age	Sex	DD	CD	PASI	WC	BMI	FPG	CHO	LDL	TGL	HDL	USG	ECG	HT	OB	DM	↑CHO	↑LDL	↑TGL	↓HDL	MS	MI	OTHERS
1	27	M	4Y	-	36.4	86	15	110	199	105	189	56	N	N	-	-	-	-	+	+	-	-	-	-
2	48	M	12Y	-	21.1	76	19.81	137	164	92	90	54	N	N	-	-	+	-	-	-	-	-	-	-
3	60	M	3m	-	43	99	24.77	94	148	88	105	39	N	N	-	-	-	-	-	-	+	-	-	-
4	27	M	10Y	-	30.4	82	20.05	77	192	138	88	36	N	N	-	-	-	-	+	-	+	-	-	-
5	56	F	10Y	HT-3m	12	109	33.73	167	388	328	95	41	FL	N	+	+	+	+	+	-	-	+	-	↑ WC
6	52	M	4Y	DM-1Y	17.6	89	22.27	225	124	61	104	42	N	N	-	-	+	-	-	-	-	-	-	-
7	54	M	26Y	DM-5Y	10.1	79	20.2	138	144	75	81	53	N	N	-	-	+	-	-	-	-	-	-	-
8	32	F	2Y	-	12.8	77	24.1	69	238	148	269	36	N	N	-	-	-	+	+	+	+	-	-	-
9	40	M	8Y	-	13.5	94	25.34	62	185	113	160	40	N	N	-	-	-	-	+	+	-	-	-	PRE OBESE
10	61	F	2Y	-	19.8	85	19.5	70	213	135	113	55	FL	N	+	-	-	+	+	-	-	-	-	-
11	47	M	8Y	-	12.1	101	31.63	62	120	52	99	48	FL	N	-	+	-	-	-	-	-	-	-	-
12	65	M	1.5Y	-	19.5	92	20.09	69	196	128	90	50	FL	N	+	-	-	-	+	-	-	-	-	-
13	55	M	2Y	-	13	109	24.17	103	223	144	167	46	FL	N	+	-	-	+	+	+	-	+	-	↑ WC
14	61	M	2Y	-	11.4	92	25.32	111	144	80	164	31	RC	N	-	-	-	-	-	+	+	-	-	PRE OBESE
15	36	M	13Y	-	10.9	76	16.6	90	130	52	110	56	N	N	-	-	-	-	-	-	-	-	-	-
16	44	M	19Y	MI,HT,PVD-3Y	13	79	18.9	84	146	59	182	51	FL	ASMI	+	-	-	-	-	+	-	-	+	PVD
17	35	F	14Y	-	13.8	63	19.98	91	225	157	96	48	N	N	-	-	-	+	+	-	-	-	-	-
18	30	M	3Y	-	12.4	75	19.47	83	156	94	99	42	N	N	-	-	-	-	-	-	-	-	-	-
19	35	F	1m	-	33	94	33.31	98	220	145	185	38	FL	N	-	+	-	+	+	+	+	+	-	↑WC
20	35	F	5m	-	22.4	79	22.59	71	189	113	117	52	FL	N	-	-	-	-	+	-	-	-	-	-

PSORIASIS VULGARIS(PASI >10)

S.NO	Age	Sex	DD	CD	PASI	WC	BMI	FPG	CHO	LDL	TGL	HDL	USG	ECG	HT	OB	DM	↑ CHO	↑ LDL	↑ TGL	↓ HDL	MS	MI	OTHERS
21	45	M	10Y	-	27.5	84	21.63	81	238	160	132	52	FL	ASMI	-	-	-	+	+	-	-	-	+	-
22	30	F	7Y	-	16.5	67	19.23	74	271	74	109	51	N	N	-	-	-	+	-	-	-	-	-	-
23	12	M	4Y	-	14.2	53	16.22	76	142	88	112	32	N	N	-	-	-	-	-	-	+	-	-	-
24	10	F	1Y	-	28.3	51	22.32	78	120	62	108	36	N	N	-	-	-	-	-	-	+	-	-	-
25	60	M	1Y	-	15.4	75	21.5	105	174	114	102	40	FL,RC	N	-	-	-	-	+	-	-	-	-	-
26	43	M	2Y	-	17.6	81	23.39	86	140	73	95	48	N	N	-	-	-	-	-	-	-	-	-	-
27	29	M	3Y	HT,DM-8m	12.4	64	24.74	107	259	196	89	45	FL	N	+	-	+	+	+	-	-	-	-	-
28	40	F	5Y	-	11.4	80	25.1	74	204	125	131	53	N	N	-	-	-	+	+	-	-	-	-	PRE OBESE
29	38	M	4Y	DM-3Y	16.8	78	21.01	110	147	63	221	40	N	N	-	-	+	-	-	+	-	-	-	-
30	30	F	2Y	-	13.5	79	24.46	70	168	105	128	37	RC	N	-	-	-	-	+	-	+	-	-	-
31	31	M	1Y	-	19.4	76	21.63	91	171	102	131	43	N	N	-	-	-	-	+	-	-	-	-	-
32	48	F	2Y	-	21.4	79	24.17	94	156	86	94	51	N	N	-	-	-	-	-	-	-	-	-	-
33	60	M	15D	-	11.4	90	19.9	97	205	139	119	42	N	N	-	-	-	+	+	-	-	-	-	-
34	65	F	1m	-	14.4	104	24.2	120	121	49	52	62	FL	N	-	-	-	-	-	-	-	-	-	↑WC
35	57	M	1m	-	14.2	67	17	52	161	96	104	44	N	N	-	-	-	-	-	-	-	-	-	-
36	62	M	3Y	-	13.2	97	26.74	63	155	89	118	42	FL	ASMI	+	-	-	-	-	-	-	-	+	PRE OBESE
37	60	M	20Y	-	12.4	72	20.32	87	175	108	130	41	N	N	+	-	-	-	+	-	-	-	-	-
38	43	M	10Y	-	11.8	107	24.3	58	189	131	90	40	FL	N	-	-	-	-	+	-	-	-	-	↑WC
39	23	F	3Y	-	22.4	66	15.56	99	158	79	174	44	FL	N	-	-	-	-	-	+	-	-	-	-
40	33	F	13Y	PVD-15Y	13.4	90	24.17	102	136	71	123	40	N	N	-	-	-	-	-	-	-	+	-	↑WC,PVD

PALMOPLANTAR PSORIASIS

S.No	AGE	SEX	DD	CD	PASI	WC	BMI	FPG	CHO	LDL	TGL	HDL	USG	ECG	HT	OB	DM	↑CHO	↑LDL	↑TGL	↓HDL	MS	MI	OTHERS
1	27	F	11m	-	4.8	81	19.6	82	190	117	110	51	N	N	-	-	-	-	+	-	-	-	-	-
2	55	M	5Y	-	2.6	82	21.23	92	153	88	93	46	N	N	-	-	-	-	-	-	-	-	-	-
3	60	M	1Y	-	2.8	98	29.75	140	169	103	136	39	FL	N	-	-	+	-	+	-	+	-	-	PRE OBESE
4	45	F	6m	-	2	58	17.12	87	162	94	75	53	N	N	-	-	-	-	-	-	-	-	-	-
5	40	M	3Y	-	1.4	90	26.4	86	189	114	203	34	FL	N	-	-	-	-	+	+	+	-	-	PRE OBESE
6	27	F	5m	-	1.2	68	19.07	100	139	53	166	53	N	N	-	-	-	-	-	+	-	-	-	-
7	40	F	1m	-	2.4	76	22.37	96	140	62	110	26	N	N	-	-	-	-	-	-	+	-	-	-
8	45	F	2Y	-	1.8	95	24.65	98	227	134	193	54	N	N	-	-	-	+	+	+	-	-	-	-
9	56	M	2Y	-	2	95	23.31	98	241	149	221	48	FL	N	+	-	-	+	+	+	-	-	-	↑WC
10	42	F	3m	-	3.2	74	15.95	76	147	94	85	36	FL	N	-	-	-	-	-	-	+	-	-	-
11	50	F	1m	HT-2Y	2.2	88	28.27	70	175	106	149	39	N	N	+	-	-	-	+	-	+	-	-	PRE OBESE
12	36	M	4Y	-	2.8	96	29.76	97	181	115	131	40	FL	N	-	-	-	-	+	-	-	-	-	PRE OBESE
13	28	M	6m	-	1.6	82	22.49	80	192	120	187	35	N	N	-	-	-	-	+	+	+	-	-	-
14	29	M	6m	-	1.4	89	23.51	92	106	47	52	51	FL	N	-	-	-	-	-	-	-	-	-	-
15	55	M	2.5m	-	2.4	81	19.82	82	165	99	89	48	N	N	+	-	-	-	-	-	-	-	-	-
16	50	F	6m	-	2	82	19.88	105	185	120	100	45	N	N	-	-	-	-	+	-	-	-	-	-
17	50	F	6m	-	2.6	101	32.27	99	345	254	220	47	N	N	+	+	-	+	+	+	-	+	-	↑WC
18	58	F	1Y	-	1.6	82	24.53	70	161	82	159	47	FL	N	-	-	-	-	-	+	-	-	-	-
19	23	F	3m	-	2	80	29.43	80	157	97	89	42	N	N	-	-	-	-	-	-	-	-	-	PRE OBESE
20	48	M	1Y	-	2.8	84	23.31	84	173	117	83	39	FL	N	-	-	-	-	+	-	+	-	-	-

PALMOPLANTAR PSORIASIS

S.NO	AGE	SEX	DD	CD	PASI	WC	BMI	FPG	CHO	LDL	TGL	HDL	USG	ECG	HT	OB	DM	↑CHO	↑LDL	↑TGL	↓HDL	MS	MI	OTHERS
21	50	F	1Y	-	2	83	26.49	79	204	134	136	43	FL	N	+	-	-	+	+	-	-	-	-	PRE OBESE
22	31	F	1Y	-	2.8	108	36.26	83	163	97	118	42	FL	N	-	+	-	-	-	-	-	-	-	↑WC
23	35	M	6m	-	1.6	80	21.26	91	181	127	89	36	FL	N	-	-	-	-	+	-	+	-	-	-
24	15	F	5Y	-	2.4	61	17.59	66	173	118	94	36	N	N	-	-	-	-	+	-	+	-	-	-
25	13	M	6Y	-	3.2	57	17.33	80	126	70	80	40	N	N	-	-	-	-	-	-	-	-	-	-
26	13	M	5m	-	4.4	82	26.03	76	141	85	100	36	N	N	-	-	-	-	-	-	+	-	-	PRE OBESE
27	13	M	4Y	-	1.8	56	13.94	84	166	99	94	48	N	N	-	-	-	-	-	-	-	-	-	-
28	14	M	2m	-	1.2	56	14.13	79	126	62	111	42	N	N	-	-	-	-	-	-	-	-	-	-
29	43	F	1Y	-	1.4	74	24.78	84	184	106	198	38	N	N	+	-	-	-	+	+	+	+	-	-
30	21	F	3Y	-	2.6	77	20.7	118	174	114	84	43	N	N	-	-	-	-	+	-	-	-	-	-
31	58	M	5Y	-	2.4	85	26.77	80	170	106	96	45	N	N	+	-	-	-	+	-	-	-	-	PRE OBESE
32	45	F	10Y	HT-2m	2	89	26.48	76	221	145	216	33	N	N	+	-	-	+	+	+	+	+	-	PRE OBESE
33	38	M	3Y	-	1.6	92	24.1	79	168	89	142	51	N	N	-	-	-	-	-	-	-	-	-	-
34	29	M	2Y	-	1.2	89	22.21	82	171	95	132	50	N	N	-	-	-	-	-	-	-	-	-	-
35	31	M	4Y	-	1.8	94	26.8	94	184	109	141	47	N	N	-	-	-	-	+	-	-	-	-	PRE OBESE

ERYTHRODERMIC PSORIASIS

S.NO	Age	Sex	DD	CD	WC	BMI	FPG	CHO	LDL	TGL	HDL	USG	ECG	HT	OB	DM	↑CHO	↑LDL	↑TGL	↓HDL	MS	MI	OTHERS
1	38	M	5Y	-	90	23.62	176	275	215	112	38	N	N	-	-	+	+	+	-	+	-	-	-
2	45	F	1Y	MI-5Y	75	19.67	98	168	89	152	49	N	IWMI	-	-	-	-	-	+	-	-	+	-
3	65	M	1Y	MI-6Y	96	22.49	70	159	109	76	35	N	IWMI	-	-	-	-	+	-	+	-	+	-
4	60	M	1m	-	94	21.34	82	165	99	95	47	RC	N	-	-	-	-	-	-	-	-	-	-
5	38	M	1Y	-	72	18.29	71	147	89	120	34	N	N	-	-	-	-	-	-	+	-	-	-
6	67	M	7m	-	82	19.49	98	213	143	141	42	N	N	-	-	-	+	+	-	-	-	-	-
7	56	M	1.5Y	-	108	30.06	74	154	98	76	41	FL	N	+	+	-	-	-	-	-	-	-	↑WC
8	58	M	1Y	-	70	17.47	88	150	95	67	42	RC	N	-	-	-	-	-	-	-	-	-	-
9	87	M	1Y	-	77	19.15	119	142	73	138	41	N	N	-	-	-	-	-	-	-	-	-	-
10	40	F	18Y	-	78	22.48	82	142	83	86	42	N	N	-	-	-	-	-	-	-	-	-	-
11	44	M	3Y	-	79	23.51	60	146	93	76	38	FL	N	-	-	-	-	-	-	+	-	-	-
12	47	M	4Y	-	113	30.11	135	200	133	133	40	N	N	-	+	+	-	+	-	-	+	-	↑WC
13	30	M	8y	-	74	18.37	109	156	94	110	40	N	N	-	-	-	-	-	-	-	-	-	-
14	40	M	1m	-	73	17.71	74	141	94	150	40	N	N	-	-	-	-	-	-	-	-	-	-
15	72	M	7m	-	75	18.37	85	141	75	128	40	RC	N	-	-	-	-	-	-	-	-	-	-
16	48	M	6m	-	70	19.53	69	144	76	138	40	N	N	-	-	-	-	-	-	-	-	-	-
17	28	F	2Y	-	74	17.47	84	148	73	121	51	N	N	-	-	-	-	-	-	-	-	-	-
18	32	M	4m	-	72	20.32	78	156	85	136	44	N	N	-	-	-	-	-	-	-	-	-	-
19	48	M	6m	-	84	23.51	86	152	75	131	50	N	N	-	-	+	-	-	-	-	-	-	DEPRES
20	38	M	1m	-	82	20.32	91	171	89	142	54	N	N	-	-	-	-	-	-	-	-	-	-

PUSTULAR PSORIASIS

S.NO	Age	Sex	DD	CD	WC	BMI	FPG	CHO	LDL	TGL	HDL	USG	ECG	HT	OB	DM	↑CHO	↑LDL	↑TGL	↓HDL	MS	MI	OTHERS
1	34	F	3Y	DM-2Y	94	28.3	92	166	105	120	37	FL	N	-	-	+	-	+	-	+	+	-	↑WC, PRE OBESE
2	53	M	3Y	-	79	23.31	79	150	89	131	42	N	N	-	-	-	-	-	-	-	-	-	-
3	50	M	15Y	MI-16Y	95	26.93	73	178	111	144	38	FL	IWMI	-	-	-	-	+	-	+	-	+	PRE OBESE
4	39	M	7Y	-	104	26.7	98	144	64	120	56	FL	N	-	-	-	-	-	-	-	-	-	↑WC
5	48	M	1.5Y	-	74	21.21	92	140	89	70	37	N	N	-	-	-	-	-	-	+	-	-	-
6	58	M	4Y	-	86	17.45	87	147	90	108	25	N	N	-	-	-	-	-	-	+	-	-	-
7	45	F	2Y	-	75	22.64	68	211	90	104	36	N	N	-	-	-	+	-	-	+	-	-	-
8	28	F	2Y	-	77	20.08	90	162	102	92	41	N	N	-	-	-	-	+	-	-	-	-	-
9	14	M	3m	-	70	17.36	92	198	128	150	40	N	N	-	-	-	-	+	-	-	-	-	-
10	65	M	3Y	-	84	22.06	91	194	115	141	51	N	N	-	-	-	-	+	-	-	-	-	-
11	52	M	3Y	DM-8Y	86	32.92	268	223	147	210	34	FL	N	-	+	+	+	+	+	+	+	-	-
12	40	F	1Y	HT-3Y	88	29.62	76	182	118	120	40	N	N	+	-	-	-	+	-	-	-	-	PRE OBESE
13	48	F	15Y	-	100	24.44	98	198	119	142	51	N	N	+	-	-	-	+	-	-	-	-	↑WC
14	25	F	2Y	-	72	21.21	89	162	84	131	52	N	N	-	-	-	-	-	-	-	-	-	-

GUTTATE PSORIASIS

S.NO	Age	Sex	DD	CD	PASI	WC	BMI	FPG	CHO	LDL	TGL	HDL	USG	ECG	HT	OB	DM	↑CHO	↑LDL	↑TGL	↓HDL	MS	MI	OTHERS
1	22	F	22D	-	38	84	23.57	73	182	96	165	53	N	N	-	-	-	-	-	+	-	-	-	-
2	36	M	1m	-	13.2	68	24.04	98	144	89	80	39	FL	N	-	-	-	-	-	-	+	-	-	-
3	21	M	10D	-	9.2	73	19.1	78	200	137	90	45	N	N	-	-	-	-	+	-	-	-	-	-
4	23	M	2Y	-	1.3	72	20.18	66	201	135	143	37	N	N	-	-	-	+	+	-	+	-	-	-
5	30	M	2m	-	7.4	75	19.05	66	174	118	87	39	N	N	-	-	-	-	+	-	+	-	-	-
6	33	M	3m	-	5.7	70	13.02	71	206	145	149	31	N	N	-	-	-	+	+	-	+	-	-	-
7	38	F	10D	-	3.3	86	26.22	62	196	104	282	36	FL	N	-	-	-	-	+	+	+	-	-	PRE OBESE
8	20	F	10Y	-	3.8	68	15.76	68	140	89	93	32	N	N	-	-	-	-	-	-	+	-	-	-
9	33	F	2Y	-	5.8	66	18.26	62	164	108	70	42	N	N	-	-	-	-	+	-	-	-	-	-
10	50	M	6Y	-	0.9	117	31.22	98	236	174	110	40	FL	N	-	+	-	+	+	-	-	-	-	↑WC
11	20	M	2Y	-	4.8	68	17.72	73	147	93	84	37	N	N	-	-	-	-	-	-	+	-	-	-
12	39	M	2Y	-	2.6	100	32.05	89	184	125	128	33	FL	N	-	+	-	-	+	-	-	-	-	-
13	14	F	2Y	-	0.9	67	16.22	72	134	66	83	51	N	N	-	-	-	-	-	-	-	-	-	-
14	11	F	3m	-	17.1	53	14.26	65	115	59	89	38	N	N	-	-	-	-	-	-	+	-	-	-
15	9	M	5m	-	3.8	56	16.26	93	140	79	89	43	N	N	-	-	-	-	-	-	-	-	-	-
16	17	F	3Y	-	7.4	62	16.23	70	251	184	80	51	N	N	-	-	-	+	+	-	-	-	-	-
17	19	F	1Y	-	5.8	73	18.96	84	159	97	124	34	N	N	-	-	-	-	-	-	+	-	-	-
18	17	M	1Y	-	3.6	69	16.6	87	168	93	178	39	N	N	-	-	-	-	-	+	+	-	-	-
19	19	M	7Y	-	4	72	19.05	96	150	72	132	52	N	N	-	-	-	-	-	-	-	-	-	-
20	8	M	6m	-	6.8	54	13.02	72	131	61	94	51	N	N	-	-	-	-	-	-	-	-	-	-
21	58	F	3Y	-	3.6	64	19.05	98	171	93	135	51	N	N	-	-	-	-	-	-	-	-	-	-
22	23	M	3Y	-	8.2	75	20.82	70	220	150	188	32	N	N	-	-	-	+	+	+	+	-	-	-

KEY TO MASTER CHART

S.NO	–	Serial number
M	–	Male
F	–	Female
DD	–	Duration of disease
Y	–	Years
m	–	Months
CD	–	Duration of comorbidity
PASI	–	Psoriasis area severity index
WC	–	Waist circumferance in cm
BMI	–	Body mass index
FPG	–	Fasting plasma glucose in mg/dl
CHO	–	Serum Cholesterol in mg/dl
LDL	–	Serum Low density lipoprotein in mg/dl
TGL	–	Serum Triglycerides in mg/dl
HDL	–	Serum High density lipoprotein in mg/dl
USG	–	Ultrasonogram abdomen
N	–	Normal
FL	–	Fatty liver
RC	–	Renal cyst

ECG	–	Electrocardiogram
ASMI	–	Anteroseptal Myocardial infraction
IWMI	–	Inferior wall Myocardial infraction
LVH	–	Left ventricular hypertrophy
UA	–	Unstable Angina
HT	–	Hypertension
OB	–	Obesity
DM	–	Diabetes mellitus
MS	–	Metabolic syndrome
MI	–	Myocardial infarction
DEPRES	-	Depression
PVD	–	Peripheral vascular disease
↑	–	Increased
↓	–	Decreased
+	–	Present
-	–	Absent

ABBREVATIONS

Th1	–	T- helper cell 1
APC	–	Antigen presenting cell
TNF α	–	Tumor Necrosis Factor α
IL 2	–	Interleukin 2
IFN γ	–	Interferon γ
IL1	–	Interleukin 1
IL6	–	Interleukin 6
IL 17	–	Interleukin17
IL20	–	Interleukin20
Th17	–	T-helper 17 cells
IL12	–	Interleukin12
IL23	–	Interleukin23
VEGF	–	Vascular Endothelial Growth Factor
CAD	–	Coronary artery disease
OR	–	Odds ratio
CI	–	Confidence interval
P	–	p-value
BMI	–	Body Mass Index
TGL	–	Triglycerides
HDL	–	High Density Lipoprotein
LDL	–	Low Density Lipoprotein
VLDL	–	Very Low Density Lipoprotein
PASI	–	Psoriasis Area Severity Index
BSA	–	Body Surface Area
NECP – ATP III	–	National Cholesterol Education Programmes Adult Panel III
NAFLD	–	Non-alcoholic Fatty Liver Disease

USG	–	Ultrasonogram
CT	–	Computed tomogram
MRI	–	Magnetic resonance imaging
COPD	–	Chronic Obsructive Pulmonary Dtsease
HT	–	Hypertension
OB	–	Obesity
DM	–	Diabetes Mellitus
DYS	–	Dyslipidemia
MS	–	Metabolic Syndrome
MI	–	Myocardial infraction